

Research and Development Program 2.3

FY 1994

Science and Technology  
Program

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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
<small>Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.</small>				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE September 1993	3. REPORT TYPE AND DATES COVERED Final 1993 to 1994		
4. TITLE AND SUBTITLE  FY 1994 Science and Technology Program		5. FUNDING NUMBERS  PE - 65801 PR - MM15 TA - N/A WU - N/A		
6. AUTHOR(S)  ARI Corporate Authors		7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  U.S. Army Research Institute for the Behavioral and Social Sciences 5001 Eisenhower Avenue Alexandria, Virginia 22333-5600		
8. PERFORMING ORGANIZATION REPORT NUMBER  ARI Research and Development Program 2.3		9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)		
10. SPONSORING / MONITORING AGENCY REPORT NUMBER		11. SUPPLEMENTARY NOTES  Point of Contact: Dr. James A. Bynum		
12a. DISTRIBUTION AVAILABILITY STATEMENT  Approved for Public Release; Distribution is Unlimited		12b. DISTRIBUTION CODE		
13. ABSTRACT (Maximum 200 words)  This document describes ARI's FY 1994 exploratory development (6.2) and advanced development (6.3A) efforts in support of the Army's Soldier-Oriented Research and Development in Personnel Performance and Training (SORD-PT) Program.  ARI's science and technology (S&T) strategy is to overcome technological barriers to more effective soldier performance and to exploit the technological opportunities provided by advances in behavioral science and related technologies. ARI's Manpower, Personnel and Training S&T program includes the Manpower and Personnel Technical Area and the Training Systems Technical Area. The exploratory development (6.2) and advanced development (6.3A) programs described in Appendices A and B, respectively, are in accordance with that to be described in the FY 1994 Army Science and Technology Master Plan (ASTMP).				
14. SUBJECT TERMS Technology Base Research and Development Manpower		Personnel Training		15. NUMBER OF PAGES 141
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED		18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED		16. PRICE CODE
19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED		20. LIMITATION OF ABSTRACT UNLIMITED		

**U. S. ARMY RESEARCH INSTITUTE (ARI)  
FOR THE BEHAVIORAL AND SOCIAL SCIENCES**

**FY 1994  
SCIENCE AND TECHNOLOGY  
PROGRAM**

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DTIC - TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
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**SEPTEMBER 1993**

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*"Today we have quality soldiers and a disciplined, spirited Army team. Soldiers know their jobs. Units train and pull together. Officers and noncommissioned officers -- each the product of a long and challenging leadership development process -- are out in front. Modern weapons and equipment give the force a critical advantage. The result is a world class Army -- on line and ready to go, an Army that knows its business. It is critical that we be able to say the same things about the future Army."*

General Gordon R. Sullivan  
Chief of Staff, U. S. Army  
*Army Posture Statement, FY93*

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## FOREWORD

This document describes ARI's FY 1994 exploratory development (6.2) and advanced development (6.3A) efforts in support of the Army's Manpower, Personnel and Training (MPT) science and technology (S&T) program. ARI's FY 1994 basic research program will be documented elsewhere. The full ARI program also includes a research-based study and analysis program (6.5-funded) which is documented in ARI R&D Program 3.3, FY 1994 Research-Based Personnel and Training Study and Analysis Program, September 1993.

## **U.S. ARMY INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES**

ARI, a field operating agency of the DA DCSPER, is the Army's lead laboratory and developing agency for manpower, personnel and training (MPT) science and technology. ARI's S&T program is executed under the supervision of the DA Deputy Chief of Staff for Personnel (DCSPER), who receives broad guidance from the Assistant Secretary of the Army for Manpower and Reserve Affairs (ASA(M&RA)) and the Assistant Secretary of the Army for Research, Development and Acquisition (ASA(RDA)).

As specified in AR 70-6 and AR 70-8, the DCSPER directs and monitors the planning, programming, budgeting and execution activities of ARI in the conduct of its comprehensive MPT S&T program. The Director of ARI, under the staff supervision of the Assistant DCSPER (ADCSPER), exercises management oversight responsibility for planning and execution of the ARI S&T program. As a developing agency, ARI's program is governed by DCSPER guidance and the provisions of AR 70-1, AR 70-6 and AR 70-8.

## INTRODUCTION

### Army Manpower, Personnel and Training (MPT) Science and Technology Vision

A high quality soldier represents the basic element of the new, smaller Army. Each must be assigned to the job that best fits his or her unique set of abilities and must be provided the best training possible. Soldiers, leaders and their units must be prepared to deploy rapidly, fight upon arrival, and win, in a wide variety of contingency operations.

The Army will focus on warrior preparation; ensuring that each soldier and unit is part of a Total Quality Force before a conflict begins. The right person will be in the right job at the right time. Leaders will be identified early and their professional development as warfighters and as leaders assured. Research-based training strategies will ensure that the Army's investments in simulated training environments and other expensive training resources (including training personnel) provide trained soldiers and units at affordable costs.

### Army MPT Science and Technology Strategy

ARI's science and technology strategy is to overcome technological barriers to more effective soldier performance and to exploit the technological opportunities provided by advances in behavioral science and related technologies.

**Technological Barriers:** As the soldier is the most important factor in warfighting, enhancement of individual and collective (unit) performance is a research issue of paramount performance. Among the MPT technology barriers to achieving more effective soldier performance are the need for:

- o More accurate methods for selecting and assigning soldiers to jobs that best fit their abilities.
- o Determinants of individual cognitive performance.
- o Determinants of collective (crew/team/unit) performance.
- o Individual and collective training strategies for synthetic training environments that prepare soldiers to cope with the proliferation of possible missions. ("The effective **application** of technological advances in the design of realistic and effective combined arms training systems gives every indication of being even more difficult to achieve than were the technology advances." (HASC Report 101-665))

**Technological Opportunities:** Recent advances in the cognitive and computer sciences have potential for lowering the barriers to more effective individual and collective human performance. These include:

- o Computer-based selection techniques for fitting a high quality soldier to the job that best fits his/her individual capabilities, validated against performance on the (simulated) battlefield.
- o Significant advances in computer technology -- virtual reality (VR) and distributed interactive simulation (DIS) -- permit development of synthetic environments for a new generation of realistic combat training programs. These advances will lead to:
  - o DIS- and VR-based training strategies for warfighting training, mission rehearsal and battle planning that takes advantage of near-real time, satellite-provided imagery.
  - o Empirical determination of how "virtual", "constructive" and "live" training environments may be used most appropriately and most cost-effectively to train warfighters, their leaders and units in support of TRADOC's Combined Arms Training Strategy (CATS).
  - o VR-based training environments for training and mission rehearsal for ground combatants, such as Special Forces teams.
- o Better understanding of team dynamics will lead to optimization of team processes for more timely and effective decision-aiding in fast-moving battlefield situations.
- o Determination and demonstration of requirements for cost-effective simulators and training devices, possessing only the minimum physical fidelity required to accomplish specific training objectives.
- o Advances in the cognitive sciences permitting development of "intelligent tutors" for the acquisition of complex cognitive skills, such as foreign languages.

## **OVERVIEW OF ARI'S SCIENCE AND TECHNOLOGY (S&T) PROGRAM**

The ARI Manpower, Personnel and Training (MPT) S&T planning process is shown in Figure 1. ARI's program structure is summarized in Figure 2.

The ARI S&T program consists of research tasks performed by ARI technical areas in Alexandria, VA, and field units throughout CONUS. Individual tasks comprising ARI's exploratory development (6.2) and advanced development (6.3A) programs are described in detail in Appendices A and B.

The following paragraphs provide a brief overview of ARI's Manpower and Personnel S&T and Training Systems S&T programs. The ARI MPT program directly supports the Army's six battlefield dynamics. Table 1 describes technology products affecting soldier across all battlefield dynamics, while Table 2 describes potential contributions to specific TRADOC Battle Labs.

### **Manpower & Personnel S&T: Investing in a Smaller, Quality Force**

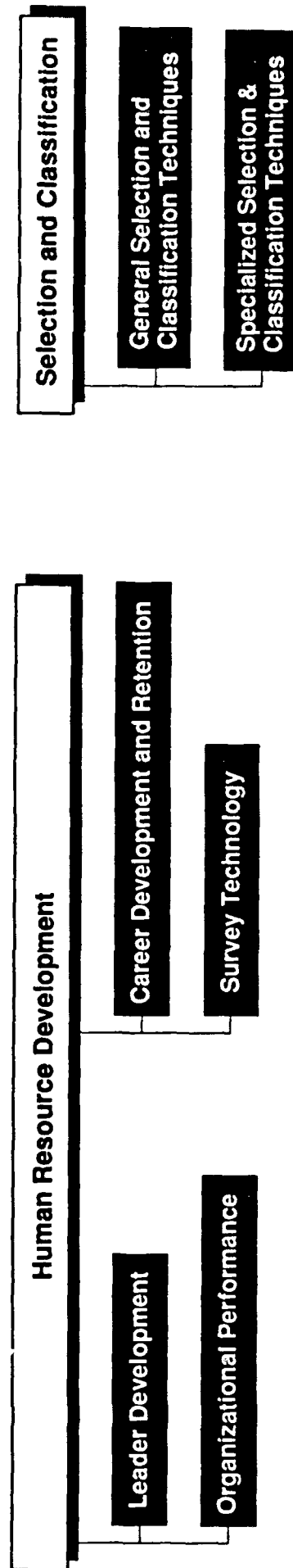
#### **Introduction:**

The mainstay of the Army is its people. The Army can only maintain readiness with a smaller force, with reduced resources, by ensuring that individuals are assigned to jobs for which they are best qualified, that they are effectively led, and that support systems and career development opportunities are in place to allow them to focus on their professional performance, both in peace and in wartime. The Manpower and Personnel science and technology program seeks to improve the Army's manpower and personnel systems through research in the broad categories of Human Resource Development and Selection and Classification. Table 1 represents some of the issues currently being addressed by ARI's manpower and personnel research program. For example, on-going research will enhance personnel capabilities by defining future leader requirements and developing new techniques to improve leader skills; technologies for developing effective commanders and staff future missions, improving the understanding of the family impacts on soldier performance and retention, and enhancing performance in selected combat arms Military Occupational Specialties (MOS) through refined selection tests.

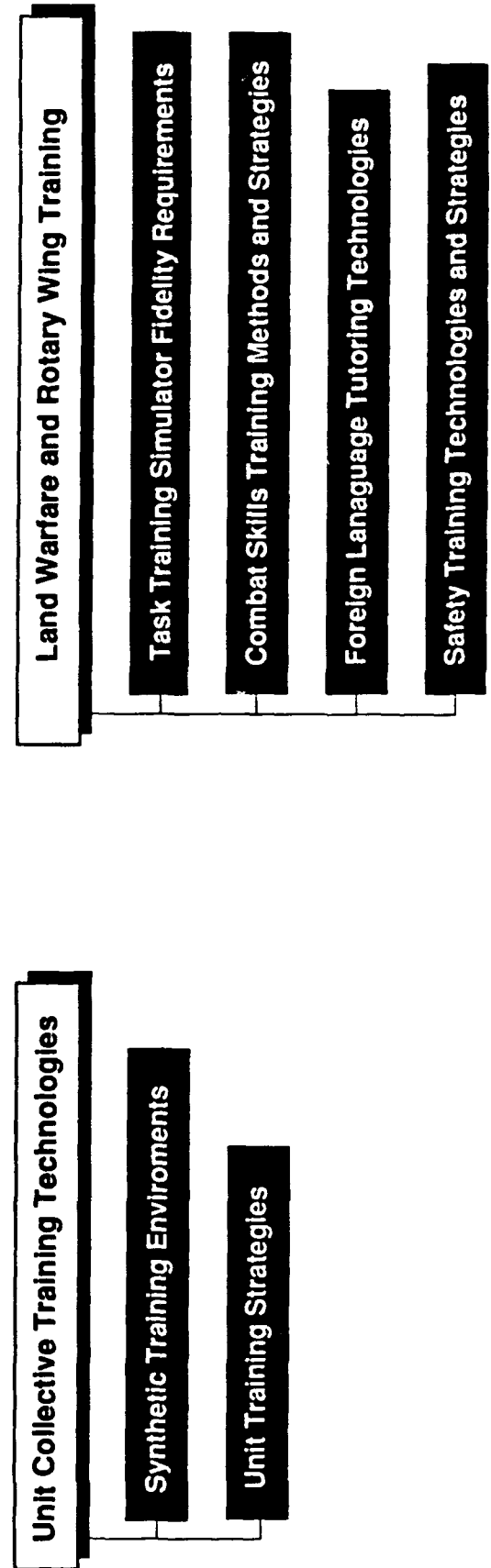


## ARI S&T Program Structure

### Manpower and Personnel S&T



### Training Systems S&T



<p style="text-align: center;"><b>Table 1</b></p> <p style="text-align: center;"><b>MANPOWER &amp; PERSONNEL ISSUES AFFECTING MILITARY READINESS AND EXAMPLE RESEARCH QUESTIONS</b></p>	
o Drawdown	o How do we retain the best and maintain morale?
o Demand for increased productivity	o Can we improve the soldier-job match?
o Demographic changes	o How do demographic changes impact accession rate and quality?
o Budget reductions	o How can we reduce personnel costs?
o Changing missions; different threats	o Do new missions require different skills? If so, what are they?
o Affordability	o Can future system be manned with current accessions?
o Higher technological skill requirements	o What new selection/classification measures are required to predict successful job performance?

**Human Resource Development.** (RELIANCE lead) A smaller Total Army must have well-qualified, trained, competent, confident leaders at all levels. Research will lead to demonstration of organizational models that will optimize the utilization of group processes and decision-making skills. Research on the most effective means to develop leaders will produce simulation strategies for enhanced training in leadership, mission planning, and decision-making skills. This research program will also expand the application of state-of-the-art survey and database technology to Army manpower and personnel research issues, and develops new technology to provide more timely information to policy makers. Research on the application of life course theory to human resource development will be directed at career, family and retention issues, with implications for human resource policies, programs and practices.

**Selection and Classification.** Psychometric and computer-assisted testing technologies will be advanced to improve the accuracy of selecting soldiers for new "high technology" MOSs, and for identifying and selecting soldiers who will be best able to perform critical combat skills. These technologies will also determine which personal characteristics can compensate for lower mental aptitude in achieving effective job performance.



## **Training Systems S&T: Training for Future Combat**

### **Introduction:**

"Training is not a cost, but an investment in readiness and our National Security."  
(AMP, Annex P-Training).

The Combined Arms Training Strategy (CATS) is the Army's architecture for training and educating its soldiers, leaders and units. The objective of the CATS architecture is to provide doctrine-based strategies for training warfighting tasks and skills in institutions, in units, and through self-development.

The Army Modernization Plan states that for the Army to meet its future training goals, as they will be articulated in CATS:

"The training vision for the Year 2000 and beyond is to produce a seamless simulation environment which allows actual combat systems, manned simulators and other simulations to exercise on a virtual battlefield."

Distributed interactive simulation (DIS) and virtual reality (VR) technology will permit the development of synthetic battlefields for training that complements field training exercises at the Combat Training Centers (CTC). Synthetic training environments built on DIS and VR technologies will enhance training opportunities. However, advances in the behavioral sciences are required to provide the training strategies that will lead to the most efficient and cost-effective utilization of these training resources.

**Unit Collective Training Technologies.** (RELIANCE lead) This program is directed at the unique contributions that behavioral science can make to the effective exploitation of synthetic environments for training. Although most attention on synthetic environments and distributed interactive simulations (DIS) technology development has been focused on computer hardware and software, the training-effectiveness of DIS-based training innovations may rest in large measure on the training strategies, performance measurement techniques, and performance feedback methods that are the products of this "behavioral technology" research program. The research products of this program support related efforts of the Simulation, Training & Instrumentation Command (STRICOM) and the Training and Doctrine Command (TRADOC). This includes virtual reality-based training strategies for individual combatants in association with STRICOM. It also includes behavioral science input to the development and validation of TRADOC's comprehensive Combined Arms Training Strategy (CATS).

**Land Warfare and Rotary Wing Training.** (RELIANCE lead) In addition to the development of unit training strategies, research is directed at guidelines for cost-effective strategies for individual soldier and small group (team/crew) training. This program of research focuses on land warfare and rotary wing training (i.e., training for

mounted, dismounted and air operations). Research will permit empirical determination of the lowest level of simulation fidelity (i.e., the least expensive equipment) required to meet critical aviation training objectives. Technologies based on recent advances in cognitive sciences will be used to demonstrate "intelligent tutors" for the acquisition and retention of foreign language skills that can be important for meeting sudden contingency missions anywhere in the world. A focus on critical small group warfighting skills addresses training requirements and solutions for such critical warfighting issues as night operations. In this period of decreasing training resources, this program also addresses the question of where elements of training should be provided -- in the "school house" or in the field.

#### **Relationship to TRADOC Battlefield Dynamics:**

To assist it in its planning for the 21st century, TRADOC has identified a number of battlefield dynamics: Early Entry, Lethality, and Survivability; Depth and Simultaneous Attack, Battle Command, Battlespace (Mounted and Dismounted), and Combat Service Support. TRADOC has chartered a Battle Lab in support of each battlefield dynamic.<sup>1</sup> In three instances, ARI has a field unit at the location of a Battle Lab:

Mounted Battlespace Battle Lab: Fort Knox, KY  
Dismounted Battlespace Battle Lab: Fort Benning, GA  
Battle Command Battle Lab: Fort Leavenworth, KA

The ARI S&T program supports TRADOC's battlefield dynamics in two ways:

Technology Products Affecting Soldiers Across All Battlefield Dynamics (Table 2)

Potential Technology Contributions to Specific TRADOC Battle Labs (Table 3)

---

<sup>1</sup> "As the method of the future, battle labs experiment in simulations and later on ranges and maneuver areas to test new ideas and technologies. They provide future capabilities by analyzing critical battlefield deficiencies and then developing, prioritizing and inserting solutions across the domains of doctrine, training, leader development, organization, materiel, and soldier requirements." (Page II-5, ASTMP, 2nd Draft, July 1993)

**Table 2: Technology Products Affecting Soldiers Across All Battlefield Dynamics**

Manpower and Personnel
o Selection of quality soldiers and assignment of the right man to the right job
o Long term effects of peacekeeping missions on soldiers' careers.
o Leader assessment and development
Training Systems
o Cost-effective unit training strategies for Reserve Component (RC) units
o Methodology for conducting front-end analyses of night operations
o Combined arms training strategies for unit home station training
o Joint Services training strategies using Advanced Distributed Simulation (ADS)

**Table 3: Potential Technology Contributions to Specific TRADOC Battle Labs**

TRADOC Battle Labs					
BATTLE COMMAND	DISMOUNTED BATTLE LAB	MOUNTED BATTLE LAB	EARLY ENTRY	DEPTH & SIMULT ATK	CBT SER SUPPORT
<ul style="list-style-type: none"> <li>o Cmd-staff orgn redesign</li> <li>o Situational awareness (SA) tng strategies</li> <li>o Visualize the battlefield</li> </ul>	<ul style="list-style-type: none"> <li>o Special Forces (SF) selection</li> <li>o SF recruiting and retention</li> <li>o Battle staff tng strategies</li> <li>o SA awareness tng strategies</li> <li>o "Own-the-night" tng strategies</li> <li>o Individual combatant simulation</li> </ul>	<ul style="list-style-type: none"> <li>o C/E armor tng strategies</li> <li>o Battlefield synchronization tng strategies</li> <li>o SA tng strategies</li> </ul>	<ul style="list-style-type: none"> <li>o Corps base redesign</li> <li>o Aviation safety training</li> </ul>	<ul style="list-style-type: none"> <li>o Aviation unit tng strategies</li> <li>o Joint ser tng strategies</li> <li>o SA tng strategies</li> <li>o Aviation safety tng</li> </ul>	

## Major FY93 Accomplishments

Table 4 shows major FY93 Manpower and Personnel S&T and Training Systems S&T program accomplishments

Table 4: Major FY93 Accomplishments	
MANPOWER AND PERSONNEL SCIENCE AND TECHNOLOGY	
Exploratory Development (6.2)	Advanced Development (6.3A)
<ul style="list-style-type: none"> <li>o Completed prototype command and control (C<sup>2</sup>) staff process model designed to enhance command staff organizational performance</li> <li>o Identified Military Occupational Specialties (MOS) where soldiers with low Armed Forces Qualification Test (AFQT) scores can perform effectively</li> <li>o Developed models of soldier career commitment and performance in a downsized environment</li> <li>o Developed compensatory screening model for predicting first-term soldier attrition</li> </ul>	<ul style="list-style-type: none"> <li>o Provided specifications for simulation technology to enhance warfighting thinking/decision making skills</li> <li>o Completed civilian survey longitudinal database for use by the Department of Army to monitor Army civilian climate</li> <li>o Developed improved procedures for assessing performance for Special Forces candidates</li> <li>o Determined best predictors of NCO success in order to improve promotion and enlistment procedures during downsizing</li> </ul>

TRAINING SYSTEMS SCIENCE AND TECHNOLOGY	
Exploratory Development (6.2)	Advanced Development (6.3A)
<ul style="list-style-type: none"> <li>o Training needs assessment for information integration/distribution tasks on dynamic future battlefield</li> <li>o Demonstrated tactically realistic scenarios within virtual environments</li> <li>o Methodology for conducting front-end analysis of night operations</li> <li>o Prototype brigade-level unit performance indicators</li> <li>o Developed unaided-vision night training program</li> </ul>	<ul style="list-style-type: none"> <li>o Demonstrated Unit Performance Assessment System (UPAS) software and users' guide for SIMNET/CCTT</li> <li>o Commander's Battle Staff Training Handbook for mounted and dismounted maneuver operations</li> <li>o Performance assessment technology and guide for use by Observers/Controllers at the Joint Readiness Training Center (JRTC)</li> <li>o Validated inflight training techniques and cockpit resource management strategies to reduce cockpit errors</li> </ul>

## OBJECTIVES AND PLANS

ARI's investment strategy covers the Army's MPT S&T program for the years FY 1994 to FY 1999. The program described in Appendices A and B is in accordance with that to be described in the 1994 ASTMP. While the program covers an extended period, the focus of this document is on the near term.

### Science and Technology Objectives

ARI's highest priority S&T tasks for the period FY94 through FY99 are covered in six Science and Technology Objectives (STO). ARI's six STOs are listed below and described in detail in Appendix C.

<u>Old</u> <u>STO #</u>	<u>New</u> <u>STO#</u>	<u>Title</u>
V.B.1	III.Q.1	Soldier Assignment
V.B.5	IV.J.5	Simulation Fidelity
V.B.6	IV.J.6	Foreign Language Skill Training
V.B.7	III.Q.2	Unit Training Strategies
V.B.8	IV.J.8	Individual Cognitive and Collective Skill Retention
V.B.9	IV.J.9	Leader and Command Staff Training

### ARI Technology Demonstrations

Technology demonstrations (tech demos) are intended to demonstrate the potential of S&T products in typical Army settings. ARI's nine tech demos, arranged in chronological order, are shown in Table 5. The nine are described briefly in terms of three major MPT thrusts in the paragraphs following the table: Manpower and Personnel, Performance Assessment and Leader Development and Training Effectiveness.

**Table 5: ARI TECHNOLOGY DEMONSTRATIONS**

<b>#</b>	<b>Tech Demo Title</b>	<b>Objective</b>	<b>Date</b>
1	Unit Performance Assessment System (UPAS) (VB7)	To demonstrate use of UPAS in a distributed interactive simulation (DIS) environment for timely/ accurate training feedback (e.g., AARs)	FY94
2	Simulator Training Research Testbed for Aviation (VB5)	To determine the minimum fidelity levels required to support aircrew training at the lowest reasonable cost	FY95
3	Battlefield Visualization (VB7)	To demonstrate a training program & job aids to help command staffs "visualize the battlefield" for improved decision making	FY95 FY98
4	Advanced Language Learning (VB6)	To demonstrate virtual reality "immersion" training techniques for language skill development	FY95 FY99
5	The Special Forces Warrior (VB1)	To demonstrate technologies to enhance SOF recruiting from within the Army and improve retention	FY96
6	Selection & Classification for High Performing Soldiers (VB1)	To demonstrate in an operational context the utility of new initial entry enlisted selection and classification (S&C) procedures for better soldier-job matching	FY97
7	Selecting the Warrior (VB1)	To demonstrate in a simulated combat environment the utility of new S&C tests for predicting combat performance	FY97
8	Developing Warfighting Leaders (VB9)	To demonstrate innovative leadership assessment and development technology	FY98
9	Individual Combatant Training in Virtual Environments (VB5)	To demonstrate individual training strategies and mission rehearsal techniques using "virtual reality" technology for key individuals and SOF high performance teams	FY98

**Manpower and Personnel Tech Demos:** Personnel quality can have a major impact on training. Brighter soldiers learn more quickly and retain information longer. When a soldier is assigned to the job that best fits his or her abilities, performance is optimized. The following tech demos are directed toward demonstrating the importance of proper selection and assignment to effective soldier performance.

**The Special Forces Warrior:** This effort will demonstrate by FY96 technologies for Special Forces warriors that enhance recruiting and selection (from within the Army), and, hence, lead to increased warfighting performance and later to retention of the most qualified personnel.

**Selecting the Warrior:** This effort will demonstrate in a simulated combat environment by FY96 the utility of new tests to select warriors based on their capability to perform in combat.

**Selection and Classification of High Performing Soldiers:** The objective of this tech demo is to demonstrate in an operational context by FY97 the utility of new procedures that will lead to improved soldier performance through selection of high quality soldiers and their assignment to jobs that best fit their capabilities during a time of rapidly-changing job requirements

**Performance Assessment and Leader Development Tech Demos:** Two of the tech demos will provide an empirical basis for determining how to assess unit performance and cost-effectively use synthetic environments for collective training.

**Unit Performance Assessment System (UPAS):** This FY94 demonstration will demonstrate UPAS, a unit performance assessment technique that can be implemented in distributed interactive simulation (DIS) environments and will enable quick and accurate training feedback (for the conduct of meaningful After Action Reviews (AAR)), and can be used to support research on the design and implementation of future DIS applications.

**Developing Warfighting Leaders:** The objective is to demonstrate by FY98 leadership assessment and development technology based on recent advances in understanding of the role of leaders in developing subordinates and the role of practical knowledge acquired from unit experiences in developing effective leader performance.

**Training Effectiveness Tech Demos:** The more focused efforts described below will also serve to provide empirical demonstration of important, cost-effective technologies for simulator-based training.



**Aviation Simulator Fidelity Demonstration:** This effort will demonstrate by FY95 fidelity levels needed to support aircrew training for initial skill acquisition and to sustain tactical and flight skills for helicopter pilots for individual and collective training.

**Battlefield Visualization:** This tech demo will demonstrate a training program and job aids to help commanders and their staffs "visualize the battlefield" (including terrain "ground truth" and the disposition of friendly and enemy forces). A preliminary training program will be demonstrated in FY95 and a complete suite of "battlefield visualization" training methods, programs and job aids demonstrated by FY99.

**Advanced Language Learning:** The objective is to demonstrate virtual reality "immersion" training techniques that develop language proficiency that will enable combatants (from foot soldiers to interrogators to strategic commanders) to carry out worldwide contingency operations. In FY95 a portable computer tutor will be demonstrated; by FY99 an "immersion" technology tutoring system will be demonstrated.

**Individual Combatant Training in Virtual Environments:** This FY98 tech demo will demonstrate individual training strategies and mission rehearsal techniques employing state-of-the-art "virtual reality" technology for key individuals (e.g., commanders) and members of high performance teams (e.g., Special Operations Forces (SOF)), which will interface with distributed interactive simulations (DIS) such the Close Combat Tactical Trainer (CCTT).

## **ARI MPT S&T Roadmaps**

The roadmaps in Figures 3 through 8 are graphical depictions of important milestones for achieving the goals specified for each of ARI's six STOs. Roadmaps are presented for the following programs:

- Figure 3: Soldier Assignment
- Figure 4: Simulation Fidelity
- Figure 5: Foreign Language Skill Training
- Figure 6: Unit Training Strategies
- Figure 7: Cognitive & Collective Skill Retention
- Figure 8: Leader & Command Staff Training

## **Manpower, Personnel and Training (MPT) S&T Program Time Lines**

An overview of ARI MPT program time lines through the FY99 POM are presented in Appendix D.

# ROADMAP FOR V.B.1 SOLDIER ASSIGNMENT

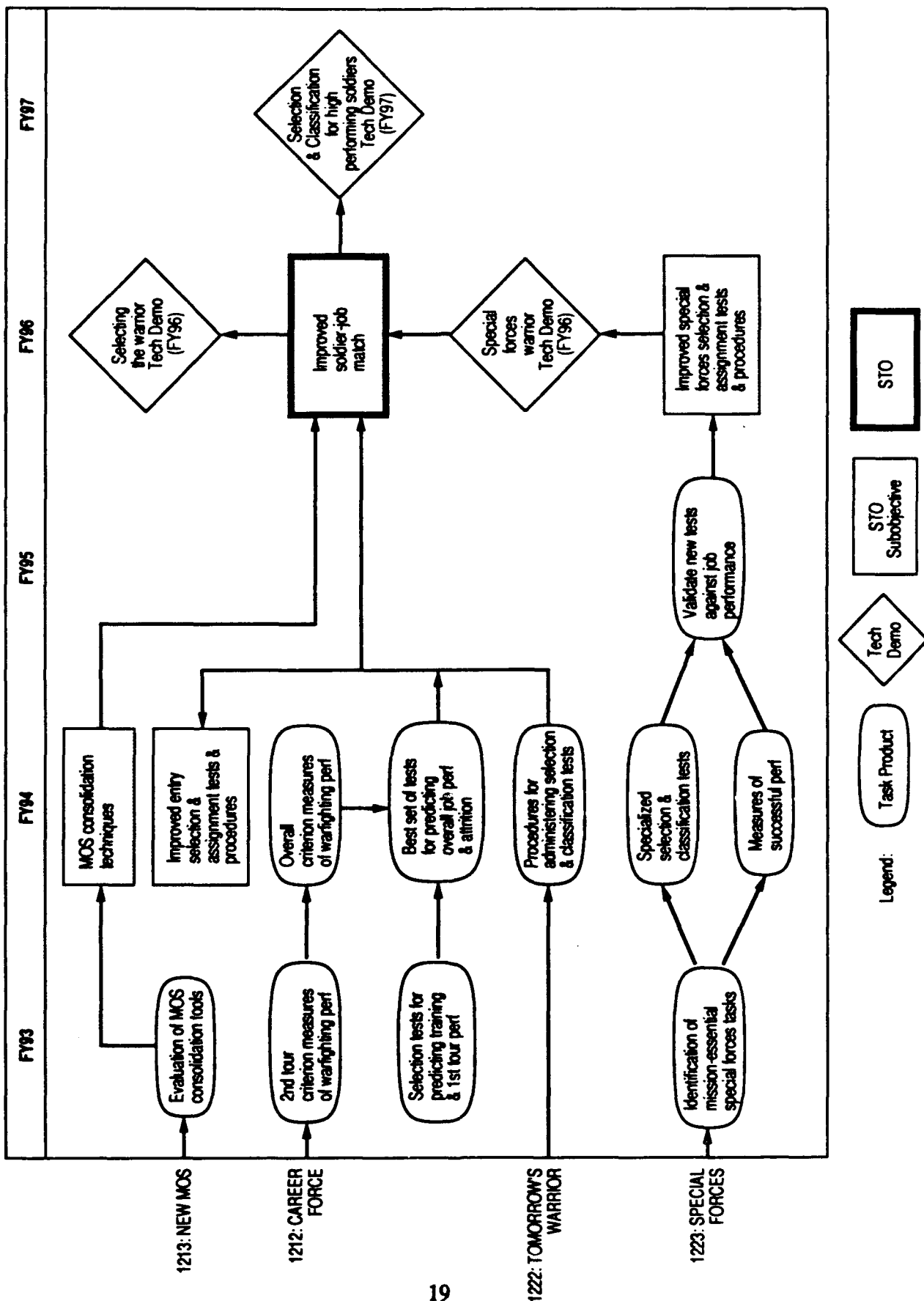
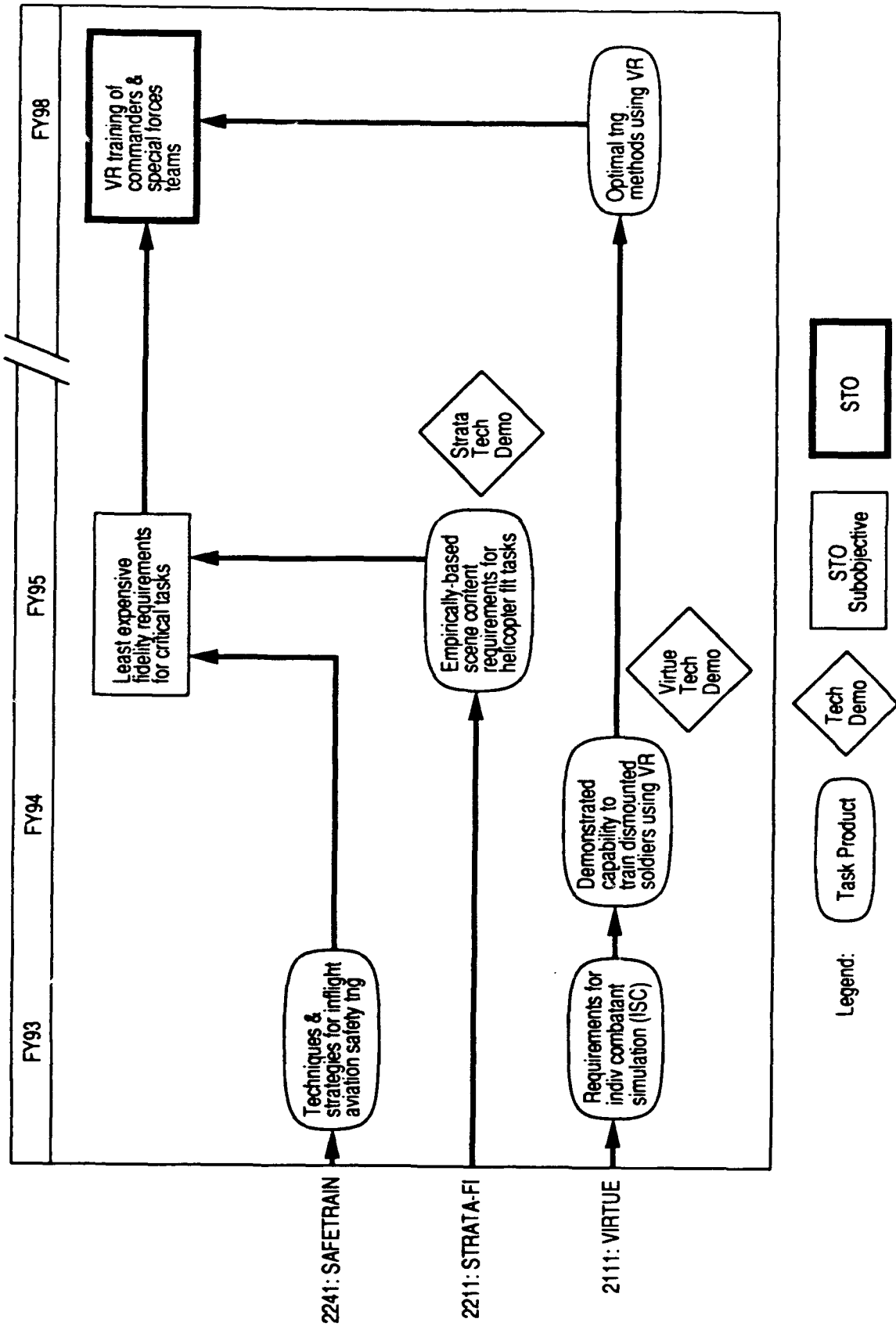


Figure 3

# ROADMAP FOR V.B.5: SIMULATION FIDELITY



SEP 92

Figure 4

# ROADMAP FOR V.B.6: FOREIGN LANGUAGE SKILL TRAINING

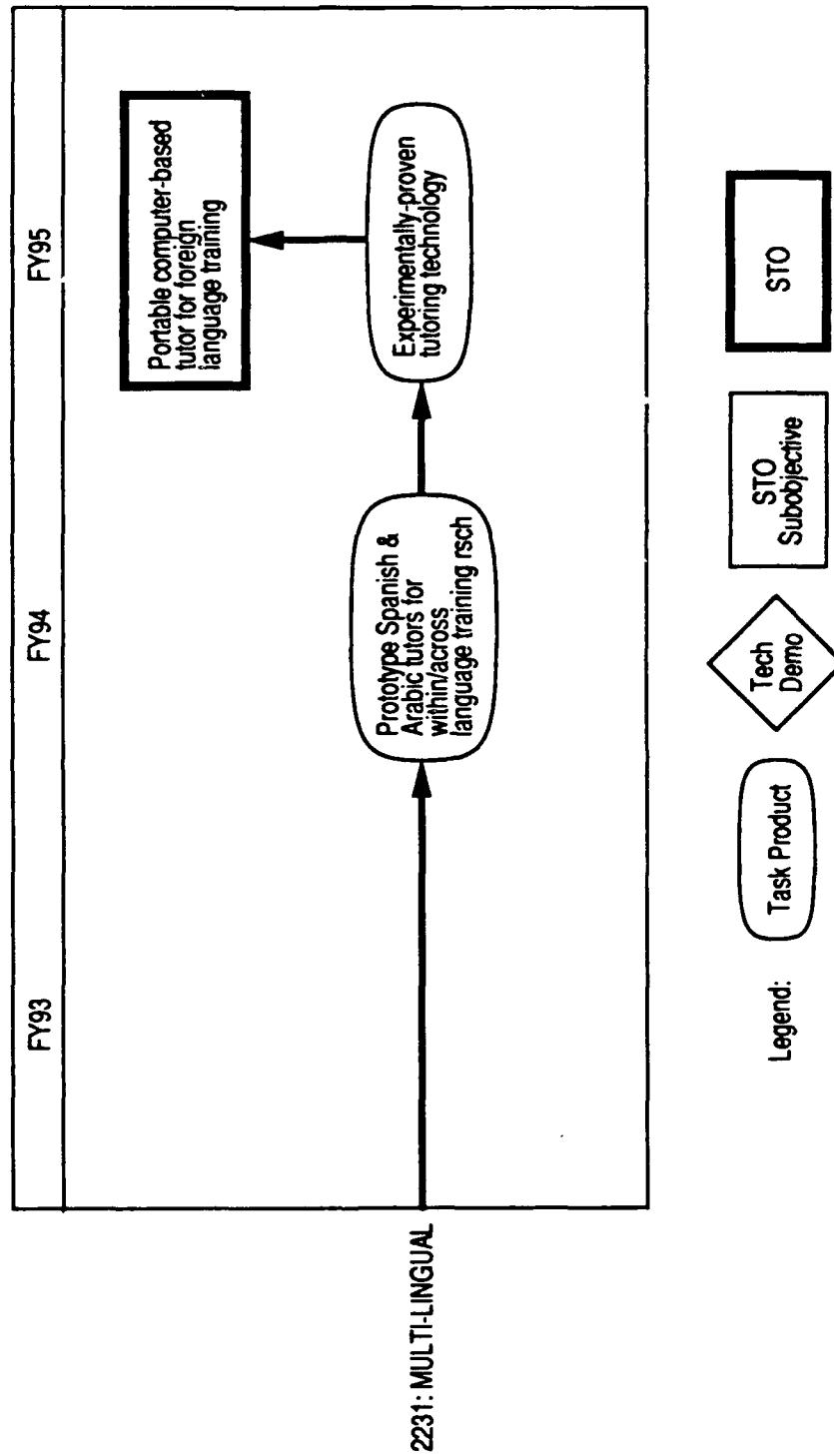


Figure 5

# V.B.7: UNIT TRAINING STRATEGIES

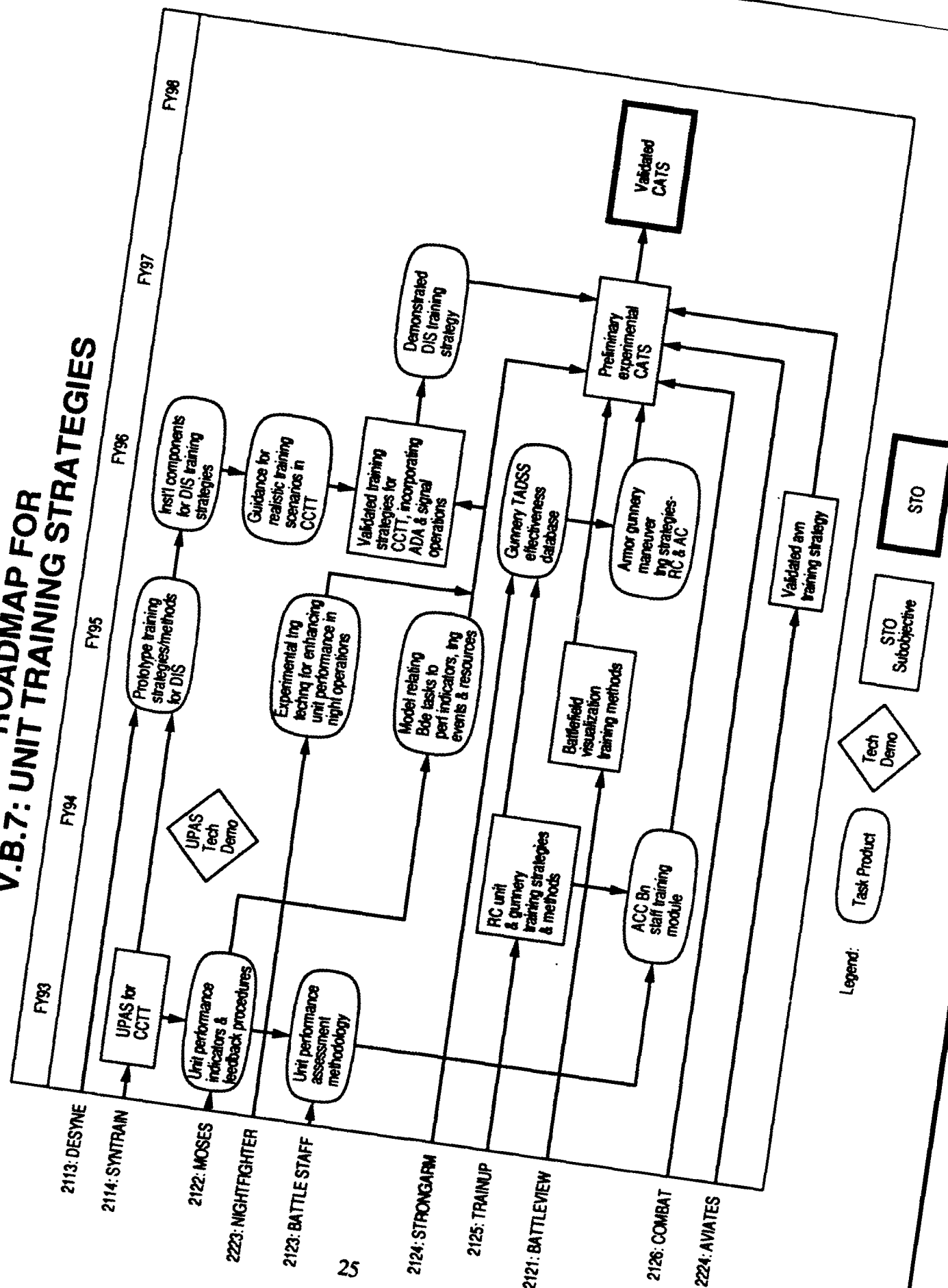


Figure 6

# ROADMAP FOR V.B.8: COGNITIVE & COLLECTIVE SKILL RETENTION

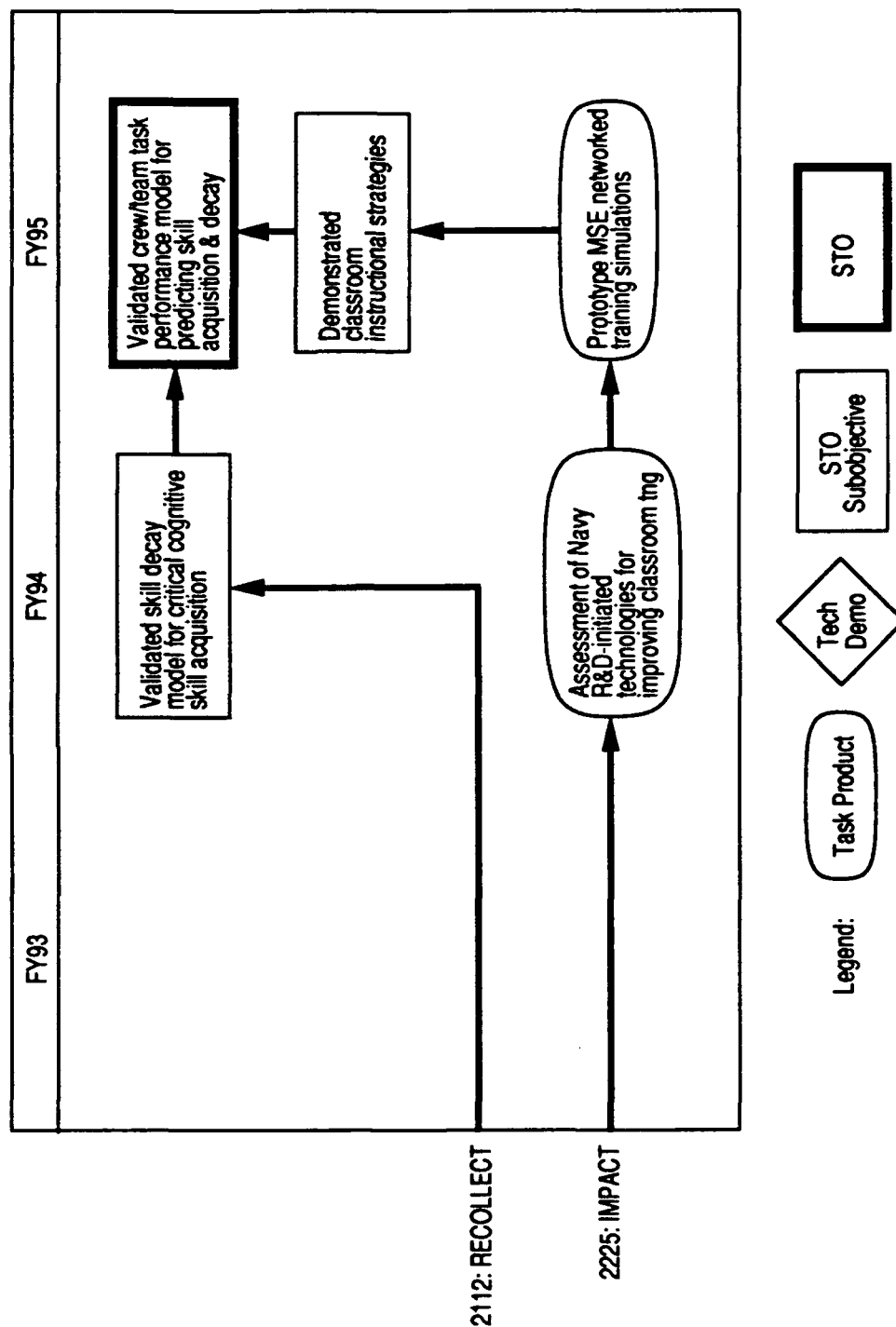
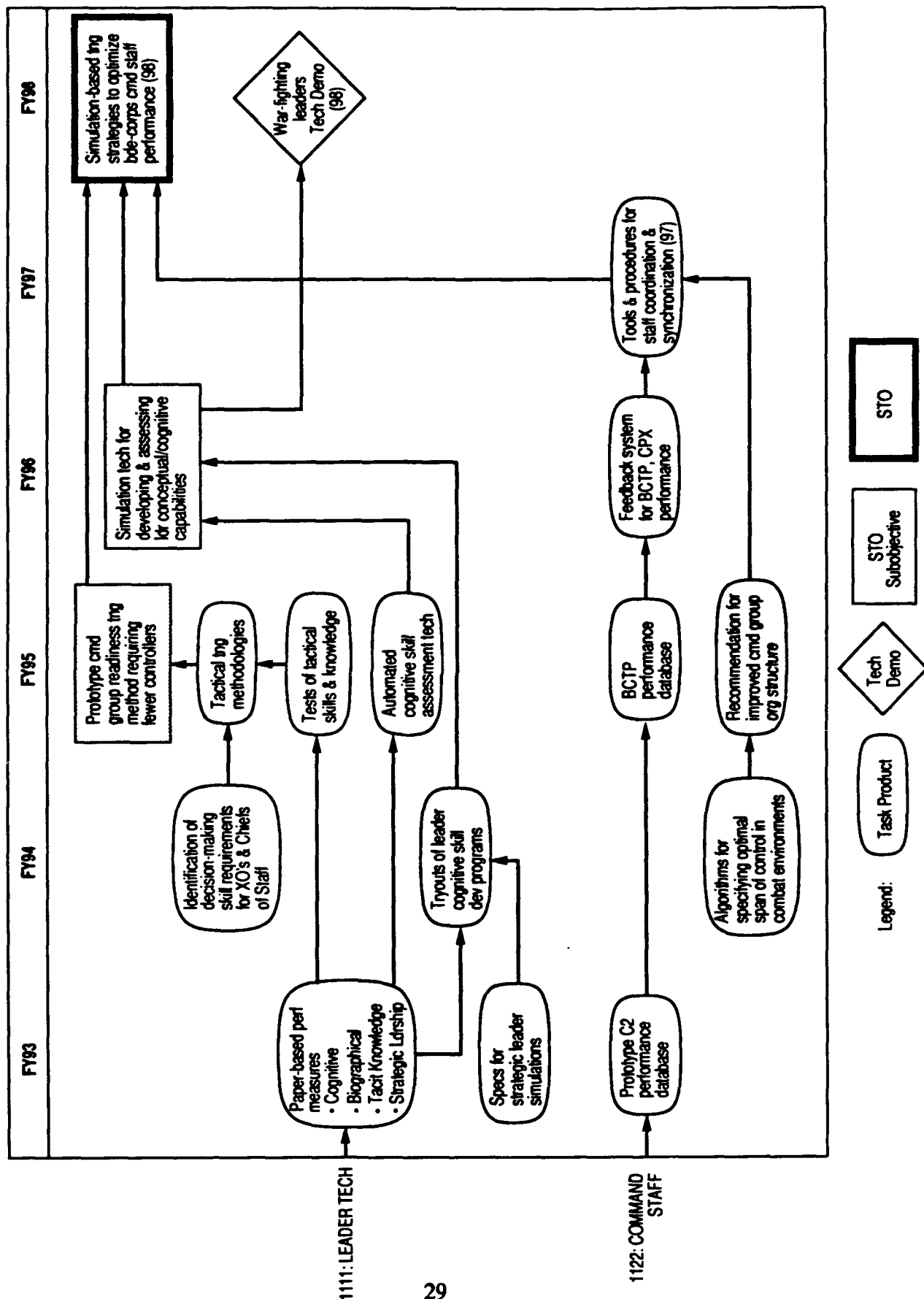


Figure 7

# ROADMAP FOR V.B.9: LEADER & COMMAND STAFF TRAINING



## Major FY94 Planned Accomplishments

Table 6 shows major planned accomplishments for FY94. Task descriptions given in Appendices A and B contain detailed information for planned FY94 accomplishments for each task.

Table 6: Major FY94 Planned Accomplishments	
MANPOWER AND PERSONNEL SCIENCE AND TECHNOLOGY	
Exploratory Development (6.2)	Advanced Development (6.3A)
<ul style="list-style-type: none"> <li>o Conceptual development of general aptitude measures which can add predictive power to current selection and classification system</li> <li>o Improved biographical measures of leadership and adaptability for officer and enlisted personnel</li> <li>o Identification of characteristics of successful leaders for use in developing improved leader development simulations</li> <li>o Analysis of long-term effects of Sinai deployment on combat mission performance and career commitment</li> </ul>	<ul style="list-style-type: none"> <li>o Personnel allocation model to match soldier capabilities to Special Forces jobs</li> <li>o Detailed assessment of the impact of downsizing and homebasing on family quality-of-life</li> <li>o Operational prototypes of psychomotor, spatial and temperament selection tests for improving performance in infantry, armor and artillery Military Occupational Specialties (MOS)</li> <li>o Selection and classification procedures for ensuring better soldier-job matching</li> </ul>
TRAINING SYSTEMS SCIENCE AND TECHNOLOGY	
Exploratory Development (6.2)	Advanced Development (6.3A)
<ul style="list-style-type: none"> <li>o Demonstrate auditory and visual components of virtual reality training environment</li> <li>o Determine long-haul network requirements for high fidelity flight simulation systems</li> <li>o Complete prototype second-generation Spanish and Arabic "intelligent tutors" for use in research on cognitive skill acquisition within and across languages</li> <li>o Demonstrate method for developing cognitive maps based on expert commander performance for "visualization of the battlefield"</li> </ul>	<ul style="list-style-type: none"> <li>o Demonstrate asynchronous computer conferencing technology for more cost-effective battle staff training</li> <li>o Demonstrate simulation-based armor gunnery training strategy for the Reserve Components</li> <li>o Empirical determination of the training capabilities of armor gunnery and maneuver training aids, devices, simulations, and simulators (TADSS)</li> <li>o Assess Navy "school house" training technologies for transition to Army classroom training</li> </ul>



## **APPENDIX A**

### **Technology Development: Exploratory Development (6.2)**

## **TECHNOLOGY DEVELOPMENT: EXPLORATORY DEVELOPMENT (6.2)**

As part of the transition to the new Army, the Army science and technology community is focusing its exploratory development efforts in 10 science and technology areas (STA).<sup>2</sup> The Army's exploratory development program will be described in Chapter IV (Technology Development) of the FY94 Army Science and Technology Master Plan (ASTMP). One of the ten S&T areas described in Chapter IV of the ASTMP is "Life, Medical and Behavioral Sciences." ARI's Manpower, Personnel and Training (MPT) exploratory development program is described briefly in this chapter of the ASTMP.

Table A-1, which shows major projected technologies from ARI's exploratory development program for FY 1995, FY 2000 and FY 2005, has been adapted from material submitted for inclusion in Chapter IV of the ASTMP.

ARI exploratory development tasks that are on-going or will start in FY94 are described in detail in this appendix, with a focus on FY94 milestones.

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<sup>2</sup> As stated in the draft 1993 Army Science and Technology Master Plan (ASTMP), dated July 13, 1993, the 10 STAs "were developed in response to (1) the needs of the CONUS-based Power Projection Army, (2) the recommendations published in the National Academy of Sciences Board on Army Science and Technology (BAST) Strategic Technologies for the Army (STAR) in 1992, and (3) the priority areas of technological interest that will give the Army its technological edge over potential adversaries -- now and in the 21st Century."

## MANPOWER, PERSONNEL AND TRAINING TECHNOLOGY MILESTONES

Technology	1995	2000	2005
Personnel Selection	<ul style="list-style-type: none"> <li>. Decision Support System</li> <li>. Identification of critical cognitive and non-cognitive skills</li> <li>. Persl assignmnt optimization tech</li> </ul>	<ul style="list-style-type: none"> <li>. Cognitive &amp; non-cognitive perf selection tests</li> <li>. Physiological stds</li> <li>. Pers strength forecasting system</li> </ul>	<ul style="list-style-type: none"> <li>. Comprehensive selection instruments</li> <li>. Job-specific assignment tests</li> <li>. Flexible career assignment system</li> </ul>
Organization Redesign	<ul style="list-style-type: none"> <li>. Simulation models for command staff design</li> </ul>	<ul style="list-style-type: none"> <li>. Organizational design models to optimize group potential</li> </ul>	<ul style="list-style-type: none"> <li>. Techniques for more effective battlefield synchronization</li> </ul>
Training Strategies for Simulated Environments & Simulation Requirements	<ul style="list-style-type: none"> <li>. Simulation fidelity rqmts criteria</li> <li>. Preliminary simulated environment (SE) tng strategies</li> <li>. Virtual reality (VR) environments for individual combatants</li> </ul>	<ul style="list-style-type: none"> <li>. Behaviorally-accurate SAFOR models</li> <li>. Mission rehearsal strategies</li> <li>. Btlefld visualization technology</li> <li>. TRADOC Combined Arms Tng Strategy (CATS) assessment technology</li> <li>. Preliminary integr of SE and VR for realistic tng</li> </ul>	<ul style="list-style-type: none"> <li>. Mission readiness estimation measures</li> <li>. Integrated tng strategies - soldier to the CINC</li> </ul>
Leader Development	<ul style="list-style-type: none"> <li>. Leader development technology: enl &amp; off</li> </ul>	<ul style="list-style-type: none"> <li>. Decision making skills training</li> <li>. Perf assess tech for unit performance</li> <li>. Leader career development model</li> </ul>	<ul style="list-style-type: none"> <li>. Advanced multi-echelon training strategies</li> </ul>

## **Innovative Ideas from Industry (I<sup>3</sup>) Program**

## **Innovative Ideas from Industry (I<sup>3</sup>) Program**

### **GOAL AND OBJECTIVES**

To stimulate faster development of innovative ideas for making significant improvements in personnel and training performance. Specific objectives of this program are to:

- o Foster innovation in the development of new technologies in the behavioral and social sciences
- o Reduce the time required to mature these technologies

### **APPROACH**

Innovative ideas are solicited from the private sector through a broad agency announcement (BAA) for the research leading to the development of new technologies in the behavioral and social sciences (and related disciplines). Individual efforts under this program range from one to two years. Preference is given to short-term proposals and to proposals that represent high-risk/high-gain initiatives (i.e., novel, state-of-the-art approaches to critical problems). Joint university/industry partnerships are encouraged.

### **TECHNOLOGY OBJECTIVES**

While the I<sup>3</sup> program considers all proposals in all areas of manpower, personnel and training exploratory development, the FY93 the program is focusing on the following areas:

**Collection and Analysis of Survey Data.** Technologies to improve the development, administration and analyses of opinion and attitude surveys that will: reduce the time needed for collection and analysis of survey data, improve the accuracy of attitude and opinion estimates, and develop new ways to develop survey items.

**Occupational Analysis and Job Structures.** Technologies for grouping jobs (Military Occupational Specialties) together that: are based on fully-developed conceptual or theoretical underpinnings, can be demonstrated to have the required reliability, are flexible, and do not require excessive personnel and/or fiscal costs to carry out.

**Models for the Redesign of Organizations.** Technologies that advance the state-of-the-art in our understanding of organizations, communications and management to maintain organizational effectiveness and improve their versatility while optimizing their size.

**Team Perfect Performance.** Technology for achieving and measuring error-free performance in teams and crews.

**Training for Mission Rehearsal.** Technologies for the development of training strategies for mission rehearsal and tactical engagement simulation that exploit advances in distributed interactive simulation (DIS), including networking and virtual reality. Experimental investigations will include critical parameters for simulation fidelity and methods for measuring transfer-of-training as a function of time.

**Techniques for The Analysis of Unit Performance Data.** Application of advanced analytic techniques, such as chaos and catastrophe theories and concept of neural networks, to maximize the utility of the data from instrumented training conducted at the National Training Center (NTC).

## **Manpower and Personnel Tasks (1.1 - 1.3)**

### **Exploratory Development**

**TASK TITLE: LEADER TECH: Leader Skill Assessment and Development Technologies (1111)**

**OBJECTIVE:** Develop and evaluate emerging technologies for leader development and assessment which could improve the capabilities of future Army leaders.

**APPROACH:** This research will explore new technologies to assess the relative contribution of the various characteristics that define the highly effective Army leader as the leader develops through his or her career. A number of different approaches will be explored, to include biographical data, cognitive assessments, and assessment of tacit leadership knowledge. New instruments will be developed and tried out on cross-sectional samples of officers at different stages in their careers. These data will be correlated with measures of leader performance and other aspects of job performance. Models of leader development at successive, critical stages in an Army career will be developed. New technologies to facilitate the growth of leader skills, to include cognitive skills and tacit leadership knowledge, will be developed and evaluated.

**PROGRESS:**

Developed methodology for cognitive task analysis to support development of decision-aiding technology

Validated model of factors critical to tactical decision making expertise

Developed framework for applying concept of Tacit Knowledge to military leadership

Developed initial version of self-development strategic leadership instrument

Completed computer-based cognitive skill assessment tool

**FY94 MILESTONES:**

Validation of measures of leadership styles for officer candidates

Preliminary model of the emergence and development of leadership behavior and effectiveness of officer candidates

Tacit knowledge for military leadership as identified by incumbent leaders

Initiate collection and compilation of data on Army officer candidates for longitudinal database on leadership development

Validated list of characteristics which distinguish tactical expertise



Cognitive analysis techniques to identify and verify decision making requirements of command and control tasks

SLDI software package completed for ICAF and USAWC use

Creative problem solving elective at ICAF

Complete proof of concept -- automated cognitive and metacognitive skill assessment and development

Completed data analysis and reporting -- Cognitive Skill Assessment Battery

First formulation of integrated theory of adult development

#### PROJECTED TECHNOLOGY:

##### FY95

Techniques for training "expert" patterning and thinking skills necessary for tactical decision making

Automated conceptual and cognitive skill assessment techniques

A framework of the mental skills used in maneuver planning

Concepts for improved situation assessment training, procedures, and decision aids

Determination of relationships between leaders' cognitive problem-solving capabilities, leadership styles, and rated effectiveness

##### FY96

Simulation technology for development and assessment of leader conceptual and cognitive skills

Validated leader assessment instruments

##### FY97

Validated theory of adult development for use in guiding development and training decisions

Validation of relationships between leaders' cognitive/problem-solving capabilities, leadership styles, and rated effectiveness

**FY98**

Simulation-based training strategies to optimize brigade-corps command staff performance

Model of the leader development process across organizational levels

War fighting leaders tech demo

Completed data on Army officer candidates for longitudinal database on leadership development

Guides for developing tacit leadership skills

Validated model of the emergence and development of effective leadership behaviors among officer candidates

\*\*\*\*\*

**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.9 Leadership and Command Staff Training

**TECHNOLOGY DEMONSTRATION:** Developing Warfighting Leaders: FY98

**DEFENSE TECHNOLOGY AREA:** Manpower and Personnel

\*\*\*\*\*

**START DATE:** FY93

**END DATE:** FY98

**FY94 FUNDING (\$000):** \$1315 **PROGRAM ELEMENT/PROJECT:** 62785 A790

**DIVISION:** Manpower and Personnel Research Division

**TECHNICAL AREA/FIELD UNIT:**

Strategic Leadership Technical Area  
Fort Leavenworth Field Unit  
United States Military Academy Field Unit

**POC:** Dr. Zita Simutis, (703) 274-8844; DSN 284-8844

**TASK TITLE: GROUP WORK: Technologies for Enhancing Command-Staff  
Organizational Performance (1121)**

**OBJECTIVE:** To understand better the factors influencing command group processes and products by exploring (1) techniques and tools for assessing the performance of staff elements and command-staff groups; and (2) methods and procedures for enhancing the performance of these elements and groups.

**APPROACH:** This research will focus on the interaction among the Commander, the command group, and the principle staff in command-staff groups involved in the leadership of combat units, brigade through corps. A particular concern will be the problems of a dispersed staff, where neither the commander nor principle staff members have face-to-face contact with subordinates. Observation and data collection in realistic CPXs and data from small-scale laboratory experiments will provide insights on the principal factors limiting effective group performance. Candidate changes in group development, structure, stability, procedures, and supporting tools will be prioritized on the basis of expected impact and feasibility. Selected interventions will be implemented and evaluated in laboratory experiments. Computer modeling techniques will also be explored to evaluate their potential use in predicting the impact on performance of changes in group structure, composition, size, and procedures.

**PROGRESS:**

Recommendations for error correction in group problem solving and decision making

Prototype MicroSaint model of command-staff processes based on field data

**FY94 MILESTONES:**

Pilot test of paradigm for distributed planning and decision making research

Methodology for identifying shared conceptual models among group members

**PROJECTED TECHNOLOGY:**

**FY95**

Computer modeling tools to assist in the design of staff groups

Taxonomy of errors in group problem solving

Methodology for identifying impact of "load sharing" on command-group effectiveness

FY96

Recommended procedures to support distributed staffs

Validation of computer modeling predictions on the impact on changes in staff size and composition on performance

Identification of impact of homogeneity vs. heterogeneity of prior experience and cognitive style within principal staff

\*\*\*\*\*

SCIENCE AND TECHNOLOGY OBJECTIVE (STO): N/A

TECHNOLOGY DEMONSTRATION:

DEFENSE TECHNOLOGY AREA: Manpower and Personnel

\*\*\*\*\*

START DATE: FY92

END DATE: FY96

FY94 FUNDING (\$000): \$208 PROGRAM ELEMENT/PROJECT: 62785 A790

DIVISION: Manpower and Personnel Research Division

TECHNICAL AREA/FIELD UNIT:

Fort Leavenworth Field Unit

POC: Dr. Stanley Halpin, (913) 684-4933; DSN 552-4933

**TASK TITLE: QUALITY SOLDIERS: Alternative Selection and Evaluation Techniques (1211)**

**OBJECTIVE:** To increase the Army's selection and classification capability through (a) new methods for measuring performance-related aptitudes; (b) improved prediction of leadership and performance under stress; and (c) increasing the validity of temperament and psychomotor/spatial tests.

**APPROACH:** New measures of performance-related aptitude, leadership, and stress tolerance will be developed and evaluated. Measurement error will be addressed by research on developing improved directions to test takers and control of test-related faking and coaching.

**PROGRESS:**

Preliminary evaluation of usefulness of biographical data for predicting attrition of officers

Preliminary evaluation of coaching effects on temperament and spatial measures

Development of strategies to counter the effects of coaching and faking on temperament measures

Demonstration of incremental validity of biographical data measure for predicting performance of West Point cadets

**FY94 MILESTONES:**

Development of forced-choice measure of temperament

Evaluation of strategies to counter the effects of coaching

Development and evaluation of trial classification system based on temperament measures

**PROJECTED TECHNOLOGY:**

**FY94**

Software, users' manuals for computer-based testing software

Methods for addressing coaching effects on temperament and spatial measures

Measures of cadet leadership potential

Improved biographical measures of adaptability of officers and enlisted personnel

FY95

Improved test composites for classification of enlisted personnel

New measures of performance related aptitude, leadership, and stress tolerance

FY96

Faking-resistant temperament measure

\*\*\*\*\*

SCIENCE AND TECHNOLOGY OBJECTIVE (STO): N/A

TECHNOLOGY DEMONSTRATION: Selection and Classification for High  
Performing Soldiers: FY97

DEFENSE TECHNOLOGY AREA: Manpower and Personnel

\*\*\*\*\*

START DATE: FY90                      END DATE: FY96

FY94 FUNDING (\$000): \$645    PROGRAM ELEMENT/PROJECT: 62785 A790

DIVISION: Manpower and Personnel Research Division

TECHNICAL AREA/FIELD UNIT:

Selection and Classification Technical Area

POC: Dr. Michael Rumsey, (703) 274-8275; DSN 284-8275

**TASK TITLE: JOB MATCH: Determining Minimal Entry Qualifications  
(1221)**

**OBJECTIVE:** To improve selection and classification for enlisted soldiers scoring below the mean on the current measure used for initial selection, the Armed Forces Qualification Test (AFQT).

**APPROACH:** Identify measurable individual characteristics, such as spatial aptitude, that can help predict performance of soldiers with average to below average cognitive aptitude. At the same time, identify Army Military Occupational Specialties (MOS) that can be performed effectively by soldiers with average to below average cognitive aptitude. Then, determine the best composite for predicting performance of the soldiers, and determine how to set minimum entry standards on these composites for individual MOS.

**PROGRESS:**

Empirical identification of predictors of performance of lower aptitude personnel

**FY94 MILESTONES:**

Development of new predictor composites for lower aptitude personnel

Identification of best job assignments for lower aptitude personnel

**PROJECTED TECHNOLOGY:**

**FY95**

New selection techniques for soldiers with low AFQT scores

\*\*\*\*\*

**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):** N/A

**TECHNOLOGY DEMONSTRATION:** N/A

**DEFENSE TECHNOLOGY AREA:** Manpower and Personnel

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**START DATE:** FY91

**END DATE:** FY95

**FY94 FUNDING (\$000):** \$336 **PROGRAM ELEMENT/PROJECT:** 62785 A790

**DIVISION: Manpower and Personnel Research Division**

**TECHNICAL AREA/FIELD UNIT:**

**Selection and Classification Technical Area**

**POC: Dr. Michael Rumsey, (703) 274-8275; DSN 284-8275**



**TASK TITLE: LIFELINE: The Life Course Approach to Human Resources  
Development Processes (1311)**

**OBJECTIVE:** To test the applicability of the emerging technology of life course theory to the investigation of major Army human resource development issues such as the continuing effects of combat on survivors and the effects of organizational and mission changes on career commitment and development in Army leaders.

**APPROACH:** The approach is two-fold. First, apply the life-course paradigm to understand how military experiences of leaders during peacekeeping missions have influenced their career development and commitment to the Army. This will be done through re-interpretation of existing data, extension of previous data collection efforts, and new data collections with leaders who have served during Sinai deployments. This first application will also test how well the life course approach can be applied to model the military experience. Second, use the life-course paradigm to further investigate and model the processes that produce changes in career development and commitment and what might be done to alleviate stresses associated with Army organizational and mission changes. Follow-up surveys of leaders who participated in Operation Restore Hope and other alternative missions will provide new data that will serve as a basis for further model development.

**PROGRESS:**

Models for the application of the life-course approach to military experiences developed

**FY94 MILESTONES:**

Survey of leaders who participated in Sinai peacekeeping missions using life course retrospective techniques

**PROJECTED TECHNOLOGY:**

**FY95**

Analysis of long-term effects of Sinai peacekeeping on leader career commitment and development using life course retrospective and event history techniques

**FY96**

Structural models of impact of peacekeeping on leader career commitment and development

**FY98**

**Longitudinal follow-up survey on leaders who participated in Operation Restore Hope using life course survey techniques**

**FY99**

**Analysis and structural models of longitudinal follow-up survey on leaders who participated in Operation Restore Hope**

**\*\*\*\*\***

**SCIENCE AND TECHNOLOGY OBJECTIVE (STO): N/A**

**TECHNOLOGY DEMONSTRATION: N/A**

**DEFENSE TECHNOLOGY AREA: Manpower and Personnel**

**\*\*\*\*\***

**START DATE: FY93                      END DATE: FY99**

**FY94 FUNDING (\$000): \$326    PROGRAM ELEMENT/PROJECT: 62785 A790**

**DIVISION: Manpower and Personnel Research Division**

**TECHNICAL AREA/FIELD UNIT:**

**Leadership and Organizational Change Technical Area**

**POC: Dr. Paul Gade, (703) 274-8293; DSN 284-8293**

**TASK TITLE: PROFILES: Personnel Survey and Database Technologies (1321)**

**OBJECTIVE:** To develop improved technologies and methods for assessing the impact of Army personnel decisions as well as other factors (psychological, economic, etc.) on soldiers' attitudes, opinions, and career decisions. This work will include the design and development of new technologies not only for surveys, but also for storing and retrieving manpower and personnel research findings. Results of this research will also lead to the development of new technologies to provide faster and more accurate research-based information to manpower and personnel policy makers.

**APPROACH:** Based on thorough reviews of the literature and of commercially available software, experimental surveys will be conducted to look at innovative ways to improve the collection, storage, analysis, interpretation, and reporting of policy relevant information from respondents. While these surveys will contain content relevant to Army personnel policy and leadership issues, the emphasis of this work is on strengthening methods for gathering such information and making it useful to sponsors. Technologies to link existing research and operational databases for rapid data retrieval will be developed. Standardized specifications for creating new, linkable databases will be developed.

**PROGRESS:**

Identification of issues regarding confidentiality

Evaluation of software started

**FY94 MILESTONES:**

Complete literature and product review of software

Initial cost and errors model developed

Experimental investigation of issues in confidentiality and data quality

**PROJECTED TECHNOLOGY:**

**FY95**

Feasibility assessment and prototype architecture for master database of Army personnel surveys

**FY96**

**Handbook of normed scales for measuring key military personnel attitudes**

**FY97**

**New Army survey delivery systems**

**\*\*\*\*\***

**SCIENCE AND TECHNOLOGY OBJECTIVE (STO): N/A**

**TECHNOLOGY DEMONSTRATION: N/A**

**DEFENSE TECHNOLOGY AREA: Manpower and Personnel**

**\*\*\*\*\***

**START DATE: FY93**

**END DATE: FY97**

**FY94 FUNDING (\$000): \$518 PROGRAM ELEMENT/PROJECT: 62785 A790**

**DIVISION: Manpower and Personnel Research Division**

**TECHNICAL AREA/FIELD UNIT:**

**Manpower and Personnel Policy Research Technical Area**

**POC: Dr. Clinton Walker, (703) 274-5610; DSN 284-5610**

**Training Systems Tasks  
(2.1 - 2.2)**

**Exploratory Development**

**TASK TITLE: VIRTUE: Virtual Environments for Combat Training and Mission Rehearsal (2111)**

**OBJECTIVE:** To demonstrate, under controlled laboratory conditions, principles of behavioral science that exploit the emerging technology known as virtual reality (VR) for training and mission rehearsal.

**APPROACH:** Develop laboratory facility and conduct experiments to determine the most cost-effective methods for immersing soldiers in visual and auditory environments. Touch, force feedback, realistic weapon simulations, and whole-body movement will be included as components of virtual environments, as the technology matures. The work will be conducted in cooperation with the Navy Training Systems Center (NTSC) Virtual Environments Training Technology Program. Experiments on training, mission planning, and mission rehearsal methods for commanders, dismounted soldiers, and the Special Operations Forces (SOF), will be conducted in conjunction with either a Distributed Interactive Simulation (DIS) training site or a SOF training site.

**PROGRESS:**

Developed scenarios for use with VR environments

Defined parameters for near-, mid-, and far-term virtual environment interface capabilities

Established VR environmental research facility

Completed review of infantry and special operations performance requirements and VR technological capabilities

Developed environment and task battery for assessing performance in VR

Obtained initial data on performance effectiveness and side effects in VR

**FY94 MILESTONES:**

Complete assessment of task performance varying visual resolution

Demonstrate capability to train individual team members using VR

Determine contribution of stereopsis in VR displays to performance

Assess effectiveness of VR for spatial knowledge acquisition

Assess capability to perform land navigation and target detection in virtual environments

**PROJECTED TECHNOLOGY:**

**FY95**

Specification of fidelity requirements for individualized team training, and demonstration of limited team training in VR environment

**FY97**

Optimal methods for training individual team members using VR

**FY98**

Commander, special forces and infantry team training and performance assessment methods for use with VR

\*\*\*\*\*

**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.5 Simulation Fidelity

**TECHNOLOGY DEMONSTRATION:** Individual Combatant Training in Virtual Environments: FY98

**DEFENSE TECHNOLOGY AREA:** Training Systems

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**START DATE:** FY92                      **END DATE:** FY98

**FY94 FUNDING (\$000):** \$588    **PROGRAM ELEMENT/PROJECT:** 62785 A791

**DIVISION:** Training Systems Research Division

**TECHNICAL AREA/FIELD UNIT:**

STRICOM/Orlando Field Unit

**POC:** Dr. Stephen Goldberg, (407) 380-4690; DSN 960-4690

**TASK TITLE: RECOLLECT: Acquisition and Retention of Collective Skills in Synthetic Training Environments (2112)**

**OBJECTIVE:** To model the development (from initial skill acquisition to skill mastery), performance proficiency, retention, and reacquisition to skill proficiency of individual and collective skills. The collective skill research will focus on development and retention of skills in synthetic training environments; the individual skill research will emphasize the reacquisition of skills in mobilization training environments. Such models will have great utility for designing more effective training programs to cope with compressed training schedules during mobilization of reservists.

**APPROACH:** Previous research in skill acquisition and retention has focused on individual skills. The current research program addresses gaps in the technology base: collective skill acquisition and retention, and individual skill reacquisition. Increased reliance on simulation for crew training and the planned networking of simulators for unit-level training requires the modeling of major variables underlying collective skill acquisition. Collective tasks performed by crews and platoons will be categorized into sets of previously learned skills, such as perceptual-motor, procedural, and problem solving. M1A1 tank crews will be the initial focus. Non-intrusive observations, structured interviews, and performance data generated by SIMNET will be collected and analyzed. A process model will be developed that predicts the performance of critical collective tasks, in terms of underlying skills/knowledge. Skill acquisition parameters in the model will project growth patterns of crew and platoon performance. For individual skill reacquisition, hands-on performance and written-test knowledge data will be collected from individual ready reservists participating in the Call Forward series of mobilization training exercises. A skill reacquisition model will be developed that predicts the amount of training required to attain proficiency as a function of task characteristics, separation interval, and personnel variables, such as AFQT score. The model developed here will enable mobilization planners to prepare rapid-train up packages for ready reservists who have been separated from active duty for periods of up to 3 years.

**PROGRESS:**

Defined the critical variables for collective skill acquisition and retention, and developed preliminary collective skill acquisition process models

Collected performance data on individual ready reservists participating in Call Forward 93 at Fort Leonard Wood



**FY94 MILESTONES:**

Initiate data collection on acquisition and retention of at least six Armor platoon tasks on SIMNET. Test predictive accuracy of collective acquisition and retention model.

Collect data on individual skill reacquisition during Call Forward 94 at Fort Lewis. Develop and test first version of individual skill reacquisition model.

**PROJECTED TECHNOLOGY:**

**FY95**

Validated model for projecting skill acquisition and decay curves for platoon level collective tasks

Model for predicting amount of retraining necessary to upgrade individual skills for soldiers who have left active duty

**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.8 Cognitive and Collective Skill Retention

**TECHNOLOGY DEMONSTRATION:** N/A

**DEFENSE TECHNOLOGY AREA:** Training Systems

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**START DATE:** FY92

**END DATE:** FY95

**FY94 FUNDING (\$000):** \$400    **PROGRAM ELEMENT/PROJECT:** 62785 A791

**DIVISION:** Training Systems Research Division

**TECHNICAL AREA/FIELD UNIT:**

Automated Instructional Systems Technical Area

**POC:** Dr. Robert Seidel, (703) 274-8838; DSN 284-8838

**TASK TITLE: DESYNE: Technology for Designing Collective Training in Synthetic Environments (2113)**

**OBJECTIVE:** To design strategies and associated methods for collective training of crews and teams in real-time synthetic combat environments (e.g., Close Combat Tactical Trainer, CCTT).

**APPROACH:** The emergence of Distributed Interactive Simulations technology provides a unique opportunity to conduct research on individuals and teams/crews under controlled, yet realistic conditions of simulated combat. Initial experiments will be conducted to determine which training features of the CCTT facilitate skill acquisition, as measured by rate and level of skill development. Subsequent research will examine the utility of various tactical knowledge training methods within CCTT exercises. Specific research issues include: (a) methods for pairing expert crews/teams with novice crews/teams during exercises to enable imitation of effective task performance procedures and mentoring by experts; (b) methods for generating collective training scenarios to address specific key training needs, (e.g., varying performance difficulty level by varying the enemy threat and/or the time provided to plan and prepare); (c) instructional features (e.g., pacing, sequencing, use of massed vs. spaced practice, and type of feedback); and (d) the use of "shared mental models" to train collective tasks. Automated tools and guidelines will be developed and demonstrated that transfer the knowledge gained from these experiments to the operational designers of collective training scenarios.

**PROGRESS:**

Model of the expert training designer and developer (i.e., description of tasks and procedures used by experts)

Created networked synthetic environment testbed for collective training research

Conducted initial experiments on cooperative learning as a training strategy facilitating the acquisition of collective skills

**FY94 MILESTONES:**

Design training strategies and methods for facilitating the acquisition of collective skills

Conduct experiments on use of shared mental models as a training strategy for facilitating the acquisition of collective skills

Design guidelines for developing collective training scenarios using shared mental models, and cooperative learning techniques

**PROJECTED TECHNOLOGY:**

**FY95**

Prototype training strategies and methods for facilitating the acquisition of collective skills in DIS environments (e.g., rules for rapid learning to high levels of skill mastery)

**FY96**

Recommended instructional dimensions for DIS training strategies (e.g., task complexity, pacing and massing vs spacing of practice)

Guidelines and support materials for the design of collective training scenarios

**FY97**

Prototype automated tools for DIS tactical engagement scenario generator for collective training

Demonstration of comprehensive DIS training strategy and associated methods

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.7 Unit Training Strategies

**TECHNOLOGY DEMONSTRATION:** N/A

**DEFENSE TECHNOLOGY AREA:** Training System

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**START DATE:** FY92

**END DATE:** FY97

**FY94 FUNDING (\$000):** \$400    **PROGRAM ELEMENT/PROJECT:** 62785 A791

**DIVISION:** Training Systems Research Division

**TECHNICAL AREA/FIELD UNIT:**

Automated Instructional Systems Technical Area

**POC:** Dr. Robert Seidel (703) 274-8838; DSN 284-8838

**TASK TITLE: BATTLEVIEW: Visualization of the Battlefield (2121)**

**OBJECTIVE:** Explore and demonstrate innovative training concepts and methodologies for improving the commander's ability to visualize the battlefield.

**APPROACH:** The research will use the data provided from highly realistic Combat Training Center (CTC) training exercises, and new, powerful computer graphical displays, along with the knowledge of experienced commanders, to develop new training technologies for commander and staff training and associated job aids. CTC data will be experimentally displayed (e.g., plan view, out-the-window, varying points-of-view) to commanders to determine how effectively these tools enable them to "visualize" the ground-truth of terrain features, friendly and enemy dispositions, and to anticipate future relationships among the forces. The "mental models" developed by expert commanders (e.g., the factors commanders take into account, their problem solving strategies and procedures, and their cognitive and perceptual skills) will be investigated to develop job aids and training strategies.

**PROGRESS:**

Literature review of battlefield visualization, the nature of expertise, and methods for extracting knowledge from experts

**FY94 MILESTONES:**

Design methods for coupling new technologies for visualizing the battlefield with cognitive/perceptual models of expert tacticians

Investigate the battle trace as a tool for visualizing the battlefield

**PROJECTED TECHNOLOGY:**

**FY95**

Training methods using computer graphic techniques to enhance visualization of the battlefield

**FY98**

Battlefield visualization training methods, programs and job aids for commander and staff

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SCIENCE AND TECHNOLOGY OBJECTIVE (STO):

V.B.7 Unit Training Strategies

TECHNOLOGY DEMONSTRATION: Battlefield Visualization: FY 95 and FY98

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY93                      END DATE: FY98

FY94 FUNDING (\$000): \$275 PROGRAM ELEMENT/PROJECT: 62785 A791

DIVISION: Training Systems Research Division

TECHNICAL AREA/FIELD UNIT:

Presidio of Monterey Field Unit

POC: MAJ Walter Craft (Acting), (408) 647-5371; DSN 878-5371

**TASK TITLE: MOSES: Military Operational Simulation and Evaluation Systems  
(2122)**

**OBJECTIVE:** To design and demonstrate a decision support methodology that allows commanders to design improved Army training strategies for brigade and above by comparing mixes of training alternatives, based on data from computer-supported battle rehearsals and simulations.

**APPROACH:** Training management models using computer-supported methods will be developed which can help commanders decide on the most effective strategy to train and prepare units for combat. The first stage of this effort will be to develop (or adapt), apply, and demonstrate techniques for identifying and defining tasks for large unit training, assessment, and feedback. This includes: (a) deriving lists of unit collective tasks and candidate assessment/feedback techniques, and (b) having SMEs screen matches of tasks and feedback techniques to test their meaningfulness, relevancy, and applicability to unit training practices. The next step will be to design, test and demonstrate methodologies for generating and evaluating tradeoffs among mixes of training alternatives (e.g., training aids, devices, simulators, and simulations (TADSS)), as a function of costs and performance benefits. Current and evolving technologies, such as Distributed Interactive Simulations (DIS), interactive models, and I-MILES, will be mapped to training events and tasks, by using statistical approaches, such as response surface analysis and linear programming.

**PROGRESS:**

Methodology to identify task clusters for brigade training strategies

Preliminary lists of task clusters

**FY94 MILESTONES:**

Development and tryout of Multi-Service Distributed Training Test Bed (MDT2) using close air support training scenarios

Define preliminary measures of Brigade performance (e.g., synchronization)

**PROJECTED TECHNOLOGY:**

**FY95**

Computer program for matrixing interrelated brigade tasks and task clusters to performance indicators, training events, and training resources (e.g., TADSS)

Guidelines for development and conduct of multi-service training in a distributed interactive simulation environment

FY96

Methodology for commanders to use in developing large unit cost-effective training program plans and schedules

\*\*\*\*\*

SCIENCE AND TECHNOLOGY OBJECTIVE (STO):

V.B.7 Unit Training Strategies

TECHNOLOGY DEMONSTRATION: N/A

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY92

END DATE: FY96

FY94 FUNDING (\$000): \$533 PROGRAM ELEMENT: PROJECT: 62785 A791

DIVISION: Training Systems Research Division

TECHNICAL AREA/FIELD UNIT:

Battlefield Training Assessment Technical Area

POC: Dr. Franklin Moses, (703) 274-5948; DSN 284-5948

**TASK TITLE: STRATA-FI: Simulation Fidelity Requirements for Cost-Effective Aviation Training (2211)**

**OBJECTIVE:** To experimentally determine essential simulation fidelity requirements for specified critical task training functions of aviation simulators.

**APPROACH:** The costs and training effectiveness of flight simulators are largely influenced by their levels of simulation fidelity. Thus, it is of vital importance to Army aviation to determine the value of different levels of fidelity for initial skill training and sustainment training of critical Army aviator tasks. Using ARI's state-of-the-art Simulator Training Research Advanced Testbed for Aviation (STRATA) as the primary research tool, all parameters of consequence to simulator design will be varied to determine their relative contribution to skill development and retention for rotary wing aviation tasks. This research will be accomplished on a task by task basis to determine the level of fidelity required to support practice on current skills or training for the acquisition of new skills in the simulator. Findings will allow training systems designers to define the lowest costs for elements of simulation systems required to effectively train the full spectrum of Army aviation tasks. In addition, experiments will be performed to assess the degree to which simulator design features affect transfer of training to actual aircraft task performance. Experiments will address the level of modularity and complexity required for networked and combined arms combat training.

**PROGRESS:**

The STRATA system was assembled, tested, and accepted at the contractor's facility, and delivered to Fort Rucker in May 1992

Experiments were conducted to: evaluate the training implications of Night Vision Goggles (NVGs) with integrated heads-up displays; validate the AH-64 simulation from both a psychophysical and handling qualities perspective

Examined the database texture requirements for nap-of-the-earth helicopter flying

**FY94 MILESTONES:**

Extend visual scene content research to tactical aviation tasks

Determine visual scene content requirements for helicopter-gunnery training

Examine helmet-mounted display system capabilities for various flight tasks



**PROJECTED TECHNOLOGY:**

**FY95**

Empirically-based scene content requirements for training helicopter flight tasks in simulators

**FY96**

Display resolution requirements for task training in helicopter flight simulators

**FY98**

Aviation task training requirements for using helmet mounted displays

Visual and other sensory requirements for training aviation tasks using networked virtual reality training environments

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.5 Simulation Fidelity

**TECHNOLOGY DEMONSTRATION:** Simulator Training Research Testbed for  
Aviation: FY95

**DEFENSE TECHNOLOGY AREA:** Training Systems

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**START DATE:** FY93                      **END DATE:** FY98

**FY94 FUNDING (\$000):** \$2236 **PROGRAM ELEMENT/PROJECT:** 62785 A791

**DIVISION:** Training Systems Research Division

**TECHNICAL AREA/FIELD UNIT:**

Fort Rucker Aviation R&D Activity

**POC:** Mr. Charles Gainer, (205) 255-4404; DSN 558-4404

**TASK TITLE: TANTAMOUNT: Technologies for Advanced Mounted Warfare Training  
(2221)**

**OBJECTIVE:** To design, develop and demonstrate simulation-based training and performance assessment technologies for commanders of advanced mounted combined arms teams, focusing on tasks which employ new battlefield sensors and new command, control and communication (C<sup>3</sup>) systems through horizontal integration of the combined arms team.

**APPROACH:** New training technologies will be designed, developed and demonstrated to prepare operators and commanders to take maximum tactical advantage of the advanced capabilities afforded by new C<sup>3</sup> systems designed for use on fast-paced, dispersed battlefields. This research will: a) identify anticipated high-tech sensors and C<sup>3</sup> components, b) specify the simulation capabilities required to immerse operators and commanders in this virtual warfighting environment, c) determine tasks and training needs associated with these futuristic systems, d) develop and demonstrate technologies for training the tasks required, and e) develop measures to assess performance and provide feedback using distributed soldier-in-the-loop simulation.

**PROGRESS:**

Prototype methods for training and assessing future tactical command and control skills

Combat Vehicle Command and Control Systems: Training implications based on company level simulations

Training requirements analysis for Combat Vehicle Command and Control System Tactical Operations Center

Description of a tank-based automated command and control system as simulated for the Combat Vehicle Command and Control program

Reconfigurable simulator specifications for future main battle tanks within the Close Combat Test Bed

Performance measures for use in simulations

**FY94 MILESTONES:**

Produce a catalog of training tools for use in Distributed Interactive Simulation (DIS) environments

Determine the training implications for the Combat Vehicle Command and Control System for battalion level simulations

**PROJECTED TECHNOLOGY:**

**FY96**

Training technologies for information distribution on the future combined arms battlefield

**FY97**

Training technologies for information integration on the future combined arms battlefield

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO): N/A**

**TECHNOLOGY DEMONSTRATION: N/A**

**DEFENSE TECHNOLOGY AREA: Training Systems**

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**START DATE: FY94**

**END DATE: FY97**

**FY94 FUNDING (\$000): \$524 PROGRAM ELEMENT/PROJECT: 62785 A791**

**DIVISION: Training Systems Research Division**

**TECHNICAL AREA/FIELD UNIT:**

Fort Knox Field Unit

**POC: Dr. Barbara Black, (502) 624-3450; DSN 464-3450**

**TASK TITLE: NIGHTFIGHTER: Training Technologies for Night Operations (2223)**

**OBJECTIVE:** To develop and demonstrate training concepts and technologies that will improve the ability of Light Infantry units to fight at night.

**APPROACH:** This research focuses on new technologies for identifying the critical problems at night for ground forces and on training technologies to reduce these problems. The first phase is development of a front-end analysis (FEA) technology for rigorously identifying Light Infantry problems at night, the reasons for these problems, and possible fixes. Multiple techniques (surveys, interviews, field observations, content analysis) will be developed to ensure a comprehensive examination of problem areas. The FEA methodology will be validated with Light Infantry missions and tasks. The second phase is the development and demonstration of training technologies, simulations, and job aiding techniques to enhance the ability of Light Infantry units to execute and sustain the difficult night tasks identified from application of the FEA method. This will include experiments with training technologies using light filtering technology, night photography, digitized forward looking infrared video, and simulations to improve the unaided and aided night vision capabilities of soldiers and units while executing mission tasks such as reconnaissance, movement, fire support, and assault. Techniques for measuring proficiency of critical night skills will be developed. Field evaluations of the training and assessment technologies will be conducted.

**PROGRESS:**

Night observations of field training in active Infantry units were recorded and analyzed

FEA procedures for identifying the critical problem areas at night using surveys and interviews were pilot tested; data were obtained from four Light Infantry units

Prototype unaided night vision training program for ground forces was developed

**FY94 MILESTONES:**

Complete the FEA methodology development and validation

Document results of Light Infantry night operations FEA

Evaluate effectiveness of unaided night vision training program for ground forces

Develop and evaluate field expedient procedure for adjusting night vision goggles to maximize visual acuity

**PROJECTED TECHNOLOGY:**

**FY96**

Training technologies for using image intensification devices and forward looking infrared sensors which will enhance unit command and control and accurate firing at night

**FY98**

Experimental training techniques and simulations for sustaining performance at night

Night performance measurement procedures

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.5 Simulation Fidelity

**TECHNOLOGY DEMONSTRATION: N/A**

**DEFENSE TECHNOLOGY AREA: Training Systems**

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**START DATE: FY92                      END DATE: FY98**

**FY94 FUNDING (\$000): \$287   PROGRAM ELEMENT/PROJECT: 62785 A791**

**DIVISION: Training Systems Research Division**

**TECHNICAL AREA/FIELD UNIT:**

Fort Benning Field Unit

**POC: Dr. Seward Smith, (706) 545-5589; DSN 835-5589**

**TASK TITLE: MULTI-LINGUAL: Advanced Technologies for Mastering Foreign Languages (2231)**

**OBJECTIVE:** To develop and demonstrate innovative instructional approaches and tutoring technologies which will improve acquisition and retention of foreign language skills, based on an improved understanding of the processes by which native English speakers acquire and retain second languages.

**APPROACH:** A set of experiments will be conducted to:

(a) Develop theoretical frameworks and cognitive models of second language acquisition and retention including individual differences in learning style; (b) Identify the major dimensions of second language acquisition and retention, and develop a computer-based research device (tutor) to be used to vary: tutoring rules (diagnosis, prescription, and remediation); student error feedback (e.g., frequency, type); immersion variables (e.g., dialogs, scenarios); modalities (visual, auditory); and cognitive task demands (e.g., exercise type); (c) Develop novel instructional approaches utilizing combinations of these dimensions in computer-based tutors for second language acquisition and retention.

**PROGRESS:**

Developed method for using a parser to create a dynamic student model.

Developed prototype, first generation, German language tutor as research environment for studying acquisition and retention

Designed and developed instructional display screens for prototype Arabic and Spanish tutors

**FY94 MILESTONES:**

Prototype, second generation, Spanish and Arabic tutors available for research on acquisition and retention within and across languages

Development of Spanish and Arabic parsers, computational lexicons, and knowledge bases to support an immersion environment for language training

Completion of research on effectiveness of tutoring rules and their interaction with individual learning styles

**PROJECTED TECHNOLOGY:**

**FY95**

Portable, computer-based tutoring technology incorporating experimentally-proven combinations of instructional variables.

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

**V.B.6 Foreign Language Skill Training**

**TECHNOLOGY DEMONSTRATION: Advanced Language Learning: FY95**

**DEFENSE TECHNOLOGY AREA: Training Systems**

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**START DATE: FY89**

**END DATE: FY95**

**FY94 FUNDING (\$000): \$977 PROGRAM ELEMENT/PROJECT: 62785 A791**

**DIVISION: Training Systems Research Division**

**TECHNICAL AREA/FIELD UNIT:**

**Automated Instructional Systems Technical Area**

**POC: Dr. Robert Seidel, (703) 274-8838; DSN 284-8838**

**TASK TITLE: SAFETRAIN II: Safety Training Technologies (2242)**

**OBJECTIVE:** To develop and evaluate emerging technologies for reducing team coordination errors among high skill individuals in time-stressed, critical environments.

**APPROACH:** This research will explore new technologies to assess and modify training, organizational, and procedural factors contributing to team coordination errors among highly skilled individuals working in time-stressed environments. The research builds upon USARI's successful development and validation of aviation crew coordination training for the Army, and explores the potential for reducing human error in other high skill teams. Specifically, the first phase of this program will focus on emergency medical teams providing advanced cardiac life support and advanced trauma life support care. Specific patterns of team errors will be identified for each stage of emergency medical care and used to develop training technologies for improving the reliability and effectiveness of physicians, nurses, and medical technicians within the emergency room setting. These training interventions will then be field validated within both a large urban hospital and a small community hospital setting to assess the impact on patient care. Subsequent phases of the program will focus attention on additional specialized Army teams, e.g., air traffic control, special operations.

**PROGRESS:** New start

**FY94 MILESTONES:**

Memorandum of agreement outlining a collaborative research program with the Health Services Command and several large military and civilian teaching hospitals

Analysis of patient care records to identify emergency medicine error patterns (obtained from hospital quality assurance records and DoD Civilian External Peer Review database)

Structured interviews with physician staffs, nursing staffs, and related emergency room personnel (conducted at several hospitals within the CONUS)

**PROJECTED TECHNOLOGY:**

**FY95**

Prototype training interventions specifically tailored to emergency medical team coordination



FY97

Prototype training techniques for other critical care medical team coordination  
(e.g., cardiac care, surgery)

Prototype training interventions for air traffic control team coordination

FY98

Prototype training interventions for special operations forces team coordination.

Generalized training technologies/methods for improving team coordination of  
highly skilled individuals working in time-stressed environments

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SCIENCE AND TECHNOLOGY OBJECTIVE (STO): N/A

TECHNOLOGY DEMONSTRATION: N/A

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY94                      END DATE: FY98

FY93 FUNDING (\$000): \$513 PROGRAM ELEMENT/PROJECT: 62785 A791

DIVISION: Training Systems Research Division

TECHNICAL AREA/FIELD UNIT:

Fort Rucker Aviation R&D Activity

POC: Dr. Dennis Leedom, (205) 255-5227; DSN 558-5227

## **APPENDIX B**

### **Technology Transition: Advanced Development (6.3A)**

### **TECHNOLOGY TRANSITION: ADVANCED DEVELOPMENT (6.3A)**

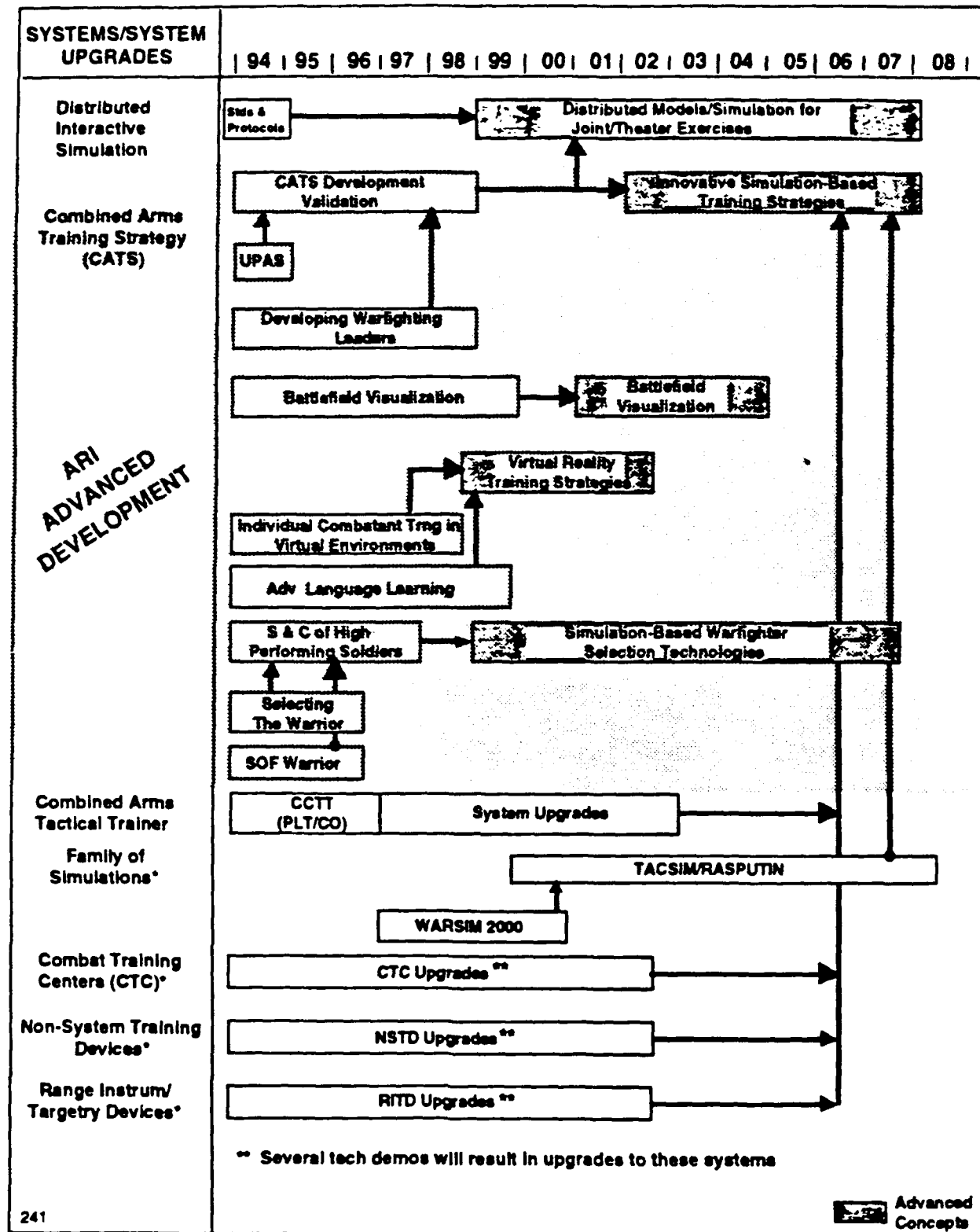
"The ultimate goal of the Army's Science and Technology (S&T) program is to provide the soldier with the winning edge on the battlefield. The accelerating pace of technological change will continue to offer significant opportunities to enhance the survivability, lethality, deployability, and versatility of Army forces.... The purpose of this chapter is to show the planned transition of promising technology developments into tomorrow's operational capabilities." (Introduction to Chapter III (Technology Transition) of the Coordination Draft of the Army Science and Technology Master Plan)

ARI's Manpower and Personnel and Training Systems S&T programs are described briefly in Section Q (Training) of Chapter III of the ASTMP. Figure 9, which has been taken from the Coordination Draft of the ASTMP, shows the Army's manpower, personnel and training roadmap for training modernization. Shown in this figure is how many of ARI's advanced development efforts directly influence training modernization, leading to higher quality soldiers and officers, training individually and collectively at reasonable cost, who will be fully prepared to meet contingency missions anywhere in the world.

ARI advanced development tasks that are ongoing or will start in FY94 are described in detail in this appendix, with an emphasis on FY94 milestones.

Figure 9

Figure III-Q-1. Roadmap for Training Modernization



**Manpower and Personnel Tasks  
(1.1 - 1.3)**

**Advanced Development**

**TASK TITLE: BATTLE COMMAND: Improving Commander and Staff Effectiveness (1122)**

**OBJECTIVE:** To determine key factors in the effectiveness of tactical and operational unit commanders and their staffs, with an emphasis on the impact of doctrine, training, and organizational influences, and to validate recommended organizational designs, procedural changes, training strategies, and decision tools for achieving effective battle command.

**APPROACH:** This research will develop and implement a database containing observations and lessons learned from Battle Command Training Program (BCTP) exercises as well as the data from ARI's Army Command and Control Evaluation System (ACCES) project. The database of scenario and performance data will be established in conjunction with the Center for Army Lessons Learned to provide a performance effectiveness baseline. Related technology base research and analyses of performance trends in the BCTP data base will suggest changes in doctrine, procedures, organization, and simulation-based training strategies; such recommendations will be implemented in selected units for evaluation and validation.

**IMPACT:** The objective performance assessment tools, the methods, procedures, and tools for organizational design, and baseline data from the BCTP data base will together support the systematic adaptation of Army battle command to technological and doctrinal change. Research products will support changes in staff training, leader development, command staff design, and command staff training strategies.

**PROPONENT/SPONSOR:** Combined Arms Command - Battle Command Battle Laboratory, TRADOC

**TECHNOLOGY TRANSFER:**

**Progress:** The Army Command and Control Evaluation System (ACCES) methodology was adopted by the Operational Test and Evaluation Command (OPTEC) in FY91. Army division baseline data has been compiled based on 11 command post exercises, and that data is available to the Center for Army Lessons Learned (CALL) and the Battle Command Battle Laboratory (BCBL) for evaluation of performance trends and assessment of experimental implementations of new command post designs, procedures, and/or training strategies. A needs analysis has established the preliminary design for a division-level performance data base (BCTPdb) and input of complete data sets from three Battle Command Training Program (BCTP) exercises is underway.

**Future Products:** ACCES, including complete training materials and analysts' guides, will be available for use by BCBL, BCTP and the Louisiana Maneuvers project in 1994 as a tool to guide observations and data collection by observers

and evaluators. Beginning in FY94 CALL is planning to use the ARI BCTPdb to identify significant issues and lessons learned emerging from BCTP and other exercises. This in turn provides information for other elements of the Combined Arms Command investigating needed changes in tactical and operational doctrine, organization and procedure. Span-of-control guidelines for organizational design and unit task organization will be provided to the BCBL in 1994. The functional BCTP data base will be integrated into the Louisiana Maneuvers Task Force (LAM TF) data base in 1995. Preliminary findings on determinants of battle command performance will be provided BCBL in 1996, with final recommendations on organizational design and simulation-based training strategies provided to BCBL and CAC-T in 1998.

**FY94 MILESTONES:**

Guidelines for organizational design with respect to leader span-of-control

Preliminary data base of BCTP data

Preliminary guidelines for evaluation of expert-system-based decision aids

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.9 Leadership and Command Staff Training

**TECHNOLOGY DEMONSTRATION:** Developing Warfighting Leaders: FY98

**DEFENSE TECHNOLOGY AREA:** Manpower and Personnel

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**START DATE:** FY93

**END DATE:** FY98

**FY93 FUNDING (\$000):** \$1619 **PROGRAM ELEMENT/PROJECT:** 63007 A792

**DIVISION:** Manpower and Personnel Research Division

**TECHNICAL AREA/FIELD UNIT:**

Fort Leavenworth Field Unit

Fort Bliss Field Unit

Leadership and Organizational Change Technical Area

ACTIVITY:

TRADOC (CAC-CD/BCBL)

ARI

POC:

BG Anderson  
DCG for Combat  
Developments and  
Director, Battle Command  
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DSN 552-2243  
(913) 684-2243

Dr. Stan Halpin  
DSN 552-4933,  
(913) 684-4933



**TASK TITLE: CAREER FORCE: Building the Career Force (1212)**

**OBJECTIVE:** Develop improved enlisted personnel procedures which will (1) select the right people, (2) put these people in the jobs they are most suited for, and (3) retain and promote the right people.

**APPROACH:** This research continues to track enlisted soldiers originally tested on general and specific aptitude measures, and then assessed on training and job performance during their first tour and into their second tour. This task refined and administered second tour measures of soldier performance, and will (1) conduct research linking entry test performance to performance at the end of training, during first tour, and in second tour, in order to identify the best combination of tests for effective selection and classification; and (2) determine the best measures to use for reenlistment and promotion decisions.

**IMPACT:** This effort will substantially improve a selection and classification system which ARI in 1989 estimated produces annual benefits to the Army of \$250 million in terms of improved performance. Benefits will also accrue from improved promotion and reenlistment decisions. Those soldiers who are chosen as junior NCOs provide leadership and continuity critical to the Army's success on the battlefield. This effort will link those decisions to proven indicators of future success.

**PROPONENT/SPONSOR:** Director of Military Personnel Management (DMPM), ODCSPER

**TECHNOLOGY TRANSFER:**

**Progress:** Results of a previous major effort, new aptitude area composites and the validation of the Army's selection and classification measures against first-tour performance were delivered in FY84 and FY86, respectively. In FY93, ARI briefed the DMPM DCSPER and the DCSPER on results of using new selection and classification measures to predict first tour performance and preliminary findings regarding prediction of second tour performance. ARI also provided to the Defense Manpower Data Center, DoD, information on a new spatial test, Assembling Objects, for possible use in selection of enlisted personnel for all Services.

**Future Products:** In FY94, ARI will deliver to DMPM, ODCSPER, new selection and classification tests incorporating psychomotor and spatial measures, with recommendations for their implementation. ARI will also deliver to DMPM in FY94 a recommended set of ratings and hands-on, knowledge, and administrative measures for predicting second tour performance, and a recommended set of procedures for implementing those measures. In FY95, ARI will complete work to tailor these measures to fit the implementation contexts identified.

**FY94 MILESTONES:**

Determination of optimal selection battery for predicting performance through first and second tours

Determination of optimal assessment battery for predicting attrition

Determination of relationship between peacetime performance and rated combat performance

Identification of individual characteristics linked to rated combat performance

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.1 Soldier Assignment

**TECHNOLOGY DEMONSTRATION:**

Selection and Classification for High Performing Soldiers: FY97

Selecting the Warrior: FY97

**DEFENSE TECHNOLOGY AREA: Manpower and Personnel**

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**START DATE: FY89**

**END DATE: FY95**

**FY94 FUNDING (\$000): \$631 PROGRAM ELEMENT/PROJECT: 63007 A792**

**DIVISION: Manpower and Personnel Research Division**

**TECHNICAL AREA/FIELD UNIT:**

Selection and Classification Technical Area

**ACTIVITY:**

DCSPER (DMPM)

ARI

**POC:**

Mr. Ron Patsy  
Enlisted Accessions  
Division  
DSN 225-0836

Dr. Michael Rumsey  
(703) 274-8275  
DSN 284-8275

**TASK TITLE: NEW MOS: Military Occupational Specialty (MOS) Restructuring (1213)**

**OBJECTIVE:** To develop guidelines and procedures for identifying and evaluating job restructuring options for Army Military Occupational Specialties (MOSs) and Career Management Fields (CMFs).

**APPROACH:** a. Develop methods to assess comparability of jobs in terms of (1) knowledge required for task performance, (2) required abilities, and (3) task difficulty, importance, and frequency. b. Determine resource constraints which impact on restructuring decisions. c. Develop methods to combine information on job comparability and resource constraints to guide restructuring decisions.

**IMPACT:** The developed job restructuring methods and procedures will result in MOS and CMF design decisions that will help optimize the Army's ability to adequately man the current and proposed inventory of systems within the available supply of soldiers.

**PROPONENT SPONSOR:** U.S. Total Army Personnel Command (PERSCOM), ODCSPER

**TECHNOLOGY TRANSFER:**

**Progress:** In FY93 ARI MOS Restructuring tools were used to develop recommendations for restructuring a set of Field Artillery MOS. These recommendations were provided to the Field Artillery School and to PERSCOM.

**Future Products:** In FY95 ARI will deliver to PERSCOM a prototype MOS restructuring decision support technology, consisting of tools to assess and integrate into MOS design: (1) required knowledge, (2) required abilities, (3) task difficulty, importance and frequency, and (4) relevant resource constraints. ARI will evaluate and make needed changes with PERSCOM to deliver an operational product in FY96.

**FY94 MILESTONES:**

Complete development of MOS Restructuring tools

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.1 Soldier Assignment

**TECHNOLOGY DEMONSTRATION:** N/A

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY89

END DATE: FY96

FY94 FUNDING (\$000): \$270 PROGRAM ELEMENT/PROJECT: 63007 A792

DIVISION: Manpower and Personnel Research Division

TECHNICAL AREA/FIELD UNIT:

Selection and Classification Technical Area (Brooks AFB)

ACTIVITY: ODCSPER (PERSCOM)

ARI

POC:

Mr. Worstine  
Chief, Military  
Occupational Systems  
Division  
(703) 695-9719

Mr. Gabriel Intano  
(210) 536-3256  
DSN 240-3256

**TASK TITLE: TOMORROW'S WARRIOR: Army Selection and Classification: General Models and MOS-Specific Needs (1222)**

**OBJECTIVE:** (1) Determine the best multi-stage model for Army selection and classification, including the activities which can most effectively be conducted at each stage. (2) Develop the best selection and classification procedures for classes of MOS with special needs, such as armor, infantry, and aviation.

**APPROACH:** a. Research to develop the best multi-stage model for Army selection and classification will: (1) describe existing procedures in terms of testing stages and testing activities, across all Services; (2) formulate alternative models, continuing to focus on testing stages and activities; and (3) evaluate the alternative models in terms of costs and benefits. b. Research on specific MOS groupings includes: (1) refinements of psychomotor, spatial and temperament measures; (2) trial use of psychomotor and spatial tests in infantry, armor, and field artillery specialties; and (3) development and evaluation of new measurement tools for aviator selection.

**IMPACT:** Improved selection and classification procedures such that each individual's abilities will be optimally matched to MOS requirements. Improved matching will result in minimal attrition and optimal job performance.

**PROPONENT/SPONSOR:** Director of Military Personnel Management (DMPM), ODCSPER

**TECHNOLOGY TRANSFER:**

**Progress:** In FY93, ARI briefed the DCSPER on progress toward development of alternative selection and classification models and on results from trial use of psychomotor and spatial tests in infantry and armor specialties. ARI also presented recommended steps toward implementing a psychomotor test for Infantry and Armor selection. The DCSPER authorized ARI to proceed with its plan. Also in FY93, ARI received support from the DCSPER to proceed with an initial test of a Compensatory Screening Model to be used to select non high school graduates.

**Future Products:** In FY94 ARI will deliver to DMPM, ODCSPER, recommendations for improved testing procedures, including cost-benefit information, which specify how particular testing procedures might best be used at each stage of the accession and training process; OASD will be briefed on these findings as well. ARI will also in FY94 proceed with the plan briefed to the DCSPER in FY93 on research to support implementation of a psychomotor test, two spatial tests, and a temperament instrument. These research efforts will be completed by FY96, at which time implementation decisions can be made.

**FY94 MILESTONES:**

Preliminary evaluation of a Compensatory Screening Model for non-high school graduates

Develop a modified one-hand tracking test for use in Infantry and Armor selection

Develop a preliminary Infantry classification system

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.1 Soldier Assignment

**TECHNOLOGY DEMONSTRATION:** Selecting the Warrior: FY97

**DEFENSE TECHNOLOGY AREA:** Training Systems

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**START DATE:** FY89                      **END DATE:** FY96

**FY93 FUNDING (\$000):** \$440 **PROGRAM ELEMENT/PROJECT:** 63007 A792

**DIVISION:** Manpower and Personnel Research Division

**TECHNICAL AREA/FIELD UNIT:**

Selection and Classification Technical Area

<b>ACTIVITY:</b>	ODCSPER (DMPM)	ARI
<b>POC:</b>	Mr. Ron Patsy Enlisted Accessions Division (703) 695-0836	Dr. Michael Rumsey (703) 274-8275 DSN 284-8275

**TASK TITLE: SPECIAL FORCES: Improving Special Forces Personnel Development  
(1223)**

**OBJECTIVE:** Develop methods, models, and strategies to enhance the ability of Special Forces to recruit, select, train, and retain highly performing soldiers who have a high propensity for a Special Forces career.

**APPROACH:** Adapt related, Army-wide work from a broad spectrum of research areas to the unique Special Forces (SF) population, and develop research tools specifically geared to SF issues. ARI first conducted a needs analysis to identify important research issues for SF personnel development. Based on those findings and sponsor priorities, ARI is developing experimental recruiting strategies, methods, handbooks, and guides. New selection devices, MOS assignment models, assessor training programs, and retention strategies and programs are also being developed in this effort.

**IMPACT:** This research will provide USASOC with better prepared recruits and higher performing soldiers through recruiting innovations, improved assessment procedures, and new selection and assignment methods. Many of the findings and implementation strategies should also be transferable to the rest of the Army, yielding enhanced soldier performance overall.

**PROPOSER/SPONSOR:** U.S. Army Special Operations Command (USASOC) and U.S. Army John F. Kennedy Special Warfare Center and School (USAJFKSWCS)

**TECHNOLOGY TRANSFER:**

**Progress:** In FY92, a Physical Training Handbook was developed to help new recruits prepare for the SF assessment and selection program. Research showed a positive impact on select rates and the Handbook is now part of the Special Forces recruiting packet. In FY93, an assessor training program was delivered to USAJFKSWCS to strengthen the skills of the assessors who rate candidates' performance in the SF selection program.

**Future Products:** Analysis of critical dimensions of performance in SF SFAS-SFQC Research database. Recommendations regarding SF selection criteria Career decision aid for SF recruits. Tools for pre-selecting SOF (Special Operations Forces) volunteers.

**FY94 MILESTONES:**

Identify critical dimensions of performance in SOF

Identify potential selection instruments and job performance measures for SOF

Develop MOS allocation model and software

Develop and evaluate a prototype career decision aid for SF recruits

Report on causes of attrition in the SF medic course

**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.1 Soldier Assignment

**TECHNOLOGY DEMONSTRATION:** N/A

**DEFENSE TECHNOLOGY AREA:** Training Systems

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**START DATE:** FY91

**END DATE:** FY94

**FY94 FUNDING (\$000):** \$1072 **PROGRAM ELEMENT/PROJECT:** 63007 A792

**DIVISION:** Manpower and Personnel Research Division

**TECHNICAL AREA/FIELD UNIT:**

Leadership and Organizational Change Technical Area  
Manpower and Personnel Policy Research Technical Area  
Selection and Classification Technical Area

**ACTIVITY:**

USASOC

ARI

**POC:**

Mr. Robert Mountel  
DSN 239-1420

Dr. Martha Teplitzky  
(703) 274-5584  
DSN 284-5584



**TASK TITLE: ARMY FAMILIES: Family Factors in Maintaining Readiness During Downsizing (1312)**

**OBJECTIVE:** To increase family adaptation to military life and to eliminate family-related barriers to individual and unit readiness.

**APPROACH:** This project has used literature searches, field visits, focus groups, analysis of existing data, and surveys to gather information on how family factors influence soldier adaptation, retention, and readiness and how family programs, policies, and practices affect the ability of families to adapt to and support the Army. The final phase will explore how families are affected by changing Army conditions (e.g., new missions and the downsizing and home basing of the force).

**IMPACT:** The information generated by this research will be used by Army leaders and program managers to increase family strengths and family support for the Army mission.

**PROPONENT/SPONSOR:** U.S. Army Community and Family Support Center (USACFSC), ODCSPER

**TECHNOLOGY TRANSFER:**

**Progress:** The principal sponsor of the research, the U.S. Army Community and Family Support Center (CFSC), used findings from the FY90 - FY91 research on family support during Operation Desert Storm and the research on increasing family adaptation to restructure and more carefully target CFSC programs.

**Future Products:** Analyses on downsizing, home basing, adaptation to peacekeeping deployments, and procedures for increasing the effectiveness of unit-based programs will be delivered in FY94.

**FY94 MILESTONES:**

The economic impacts of home basing

Family support during Operation Restore Hope

Programs that increase family adaptation to the Army

Indirect delivery of family services: A review

Mechanisms for accomplishing indirect services

Commanders' reaction to the indirect family service delivery system

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SCIENCE AND TECHNOLOGY OBJECTIVE (STO): N/A

TECHNOLOGY DEMONSTRATION: N/A

DEFENSE TECHNOLOGY AREA: Manpower and Personnel

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START DATE: FY86

END DATE: FY94

FY94 FUNDING (\$000): \$209 PROGRAM ELEMENT/PROJECT: 63007 A792

DIVISION: Manpower and Personnel Research Division

TECHNICAL AREA/FIELD UNIT:

Leadership and Organizational Change Technical Area

ACTIVITY:

TRADOC (USACFSC)

ARI

POC:

Dr. Richard Fafara  
(703) 325-4356  
DSN 221-4356

Dr. D. Bruce Bell  
(703) 274-8119  
DSN 284-8867

**Training Systems Tasks  
(2.1 - 2.2)**

**Advanced Development**

**TASK TITLE: SYNTRAIN: Development of Advanced Training Technologies for Distributed Interactive Simulation (DIS) Systems (2114)**

**OBJECTIVE:** To develop and demonstrate a training and performance measurement and feedback design technology that takes full advantage of current and emerging distributed interactive simulation (DIS) systems to improve the effectiveness and efficiency of Combined Arms Unit Training (i.e., design the DIS component of the Combined Arms Training Strategy, CATS).

**APPROACH:** Distributed Interactive Simulation, or DIS, provides the Army with an opportunity to increase training readiness while reducing costs for live ammunition, fuel, and weapons systems maintenance, and for avoiding real-world safety hazards. However, DIS cannot be designed to recreate the physical conditions found in field training or in combat operations. This effort will develop the training design principles to optimize the cost and training effectiveness of DIS. An ARI-developed Unit Performance Assessment System (UPAS), a method for measuring performance and providing training feedback in networked simulators, will serve as a basis for further research. Lessons Learned from its implementation will guide the development of data collection and After Action Review (AAR) aids for the Close Combat Tactical Trainer (CCTT). In addition, the UPAS will be modified, as necessary, to support research on (1) the application of DIS to joint service close air support training and (2) the use of knowledge databases to guide the preparation of AAR aids automatically. Research will determine how air defense artillery (ADA) and signal communications should be incorporated into close combat simulations to increase the realism and effectiveness of DIS training. Incorporation of results of other exploratory development programs on effective DIS instructional features, feedback, sequencing and pacing, and use of massed vs. distributed practice (e.g., the DESYNE project) will form the basis of a methodology for developing prototype training programs and their scenarios.

**IMPACT:** Results of this research task will help STRICOM and TRADOC to ensure that the CCTT and other DIS training systems provide units with the simulated operational experiences that meet their training needs.

**PROPOSERS/SPONSORS:** Simulation, Training and Instrumentation Command (STRICOM), AMC; TRADOC System Manager for Combined Arms Tactical Trainer (TSM CATT), TRADOC; Defense Modeling and Simulations Office, OSD

**TECHNOLOGY TRANSFER:**

**Progress:** In FY92, the prototype UPAS was accepted in OSD as the design objective for the DOD DIS performance measurement standard, and recommended for implementation with SIMNET by TSM, CATT. In FY93, UPAS software and user's guide for collecting and analyzing data from SIMNET was transferred to STRICOM and TRADOC for implementation at the Fort Knox

Combined Arms Tactical Training Center (CATTC). DMSO provided funding to upgrade the UPAS to DIS Version 2.0 and modify the displays for use in close air support (CAS) training.

**Future Products:** In FY94, a version of UPAS upgraded to DIS protocols from SIMNET protocols and containing data displays for CAS training will be transferred to STRICOM, TRADOC, and OSD. In FY 95, a work-station-based version of UPAS that guides the preparation of After Action Review aids automatically using a knowledge database will be transferred to STRICOM and TRADOC. In FY96, guidance for generating realistic tactical scenario options for training in CCTT, to include ADA and signal communications variables will be transferred to STRICOM and TRADOC. Prototype DIS training modules will be transferred to demonstrate the methodology - for Special Operations Forces mission planning in FY97; and for dismounted infantry in FY98. By FY98, guidelines for employing effective instructional features and strategies will be incorporated in a tested and validated DIS training support package, for use by DIS training and materiel developers.

#### **FY94 MILESTONES:**

Put UPAS data collection and display capabilities on a work station

Initiate development of knowledge database for AAR aid production

Modify UPAS to aid CAS training

Initiate research on amounts and kinds of training appropriate for SIMNET/CCTT as part of CATS

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#### **SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.7 Unit Training Strategies

**TECHNOLOGY DEMONSTRATION:** Unit Performance Assessment System: FY94

**DEFENSE TECHNOLOGY AREA:** Training Systems

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**START DATE:** FY92

**END DATE:** FY98

**FY94 FUNDING (\$000):** \$587 **PROGRAM ELEMENT/PROJECT:** 63007 A793

**DIVISION:** Training Systems Research Division

**TECHNICAL AREA/FIELD UNIT:**

STRICOM/Orlando Field Unit

**ACTIVITY:** AMC (STRICOM) ARI

**POC:** COL James Shiflett Dr. Stephen Goldberg  
PM CATT (407) 380-4690  
DSN 960-8299 DSN 960-8173

TRADOC (TSM CATT)

COL Robert White  
TSM CATT  
DSN 464-1600

**TASK TITLE: BATTLESTAFF: Battle Staff Training and Integration (2123)**

**OBJECTIVE:** To develop and demonstrate innovative staff training strategies and performance assessment methodologies to enhance maneuver battalion readiness for Airland Operations.

**APPROACH:** A systematic analysis of current and projected Joint Readiness Training Center/National Training Center (JRTC/NTC) observer data collection procedures, processing capabilities, and command requirements will support the design of an improved staff performance assessment methodology to be used in the field (e.g., at JRTC). A computer-based staff training program will be developed and evaluated. The relative performance of units using prototype training programs and products will be evaluated by employing JRTC observer/controllers' performance assessment of units training in the field to determine program effectiveness.

**IMPACT:** This research will assist the Army's capability of deploying combat ready battalions, able to meet dynamic conventional and contingency mission requirements. The research will improve battalion staff training, synchronization, and functional integration for Airland operations for both AC and RC units. All units and the CTCs will benefit from enhanced performance measurement standardization and assessment strategies.

**PROPONENT/SPONSOR:** Combined Arms Command-Training (CAC-T), TRADOC

**TECHNOLOGY TRANSFER:**

**Progress:** A field-tested Commander's Battle Staff Training Handbook draft and a performance assessment methodology and guide for observer/controllers at the JRTC, was transferred in FY93 to TRADOC for implementation.

**Future Products:** An experimental computer-based (Asynchronous Computer Conferencing) battalion staff training module will be demonstrated in FY94 and recommended for use by TRADOC.

**FY94 MILESTONES:**

Complete development and validation of computer-based battalion staff training program

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**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.7 Unit Training Strategies

**TECHNOLOGY DEMONSTRATION:** N/A

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY92

END DATE: FY94

FY94 FUNDING (\$000): \$537 PROGRAM ELEMENT/PROJECT: 63007 A793

DIVISION: Training Systems Research Division

TECHNICAL AREA/FIELD UNIT:

Fort Benning Field Unit

ACTIVITY:

TRADOC (CAC-T)

ARI

POC:

BG Nash  
DSN 552-5501

Dr. Seward Smith  
(706) 545-5589  
DSN 835-5589



**TASK TITLE: STRONGARM: Strategies for Training and Assessing Armor Commanders' Performance with Devices and Simulations (2124)**

**OBJECTIVE:** To provide the empirical basis for identifying mixes of armored unit training resources that best match current and future requirements and enhance readiness.

**APPROACH:** To provide an empirical foundation for armor training strategies, research will be conducted to assess the tasks and skills that can be trained with gunnery and maneuver training aids, devices, simulators, and simulations (TADSS). The research will include development of analytic and empirical methods for assessing and projecting the training capabilities of specific TADSS, and the development of a prototype simulation-based armor training program. These efforts will support development and refinement of semi-automated performance measurement systems (such as the Unit Performance Assessment System (UPAS)), development and validation of required levels of proficiency ("gates"), and development and evaluation of alternative TADSS-based training methods. Future needs for TADSS will be identified through close monitoring of related technology-based research and results of training with fielded TADSS. Analytic methods will be applied to project appropriate mixes of resources in future training strategies.

**IMPACT:** This research will provide information necessary for building and validating armor training strategies. It will provide a foundation for training strategies based on more than listings of projected resources and events. The payoff should be more effective and efficient TADSS-based strategies not only for armor training, but also for combined arms training.

**PROPONENT/SPONSOR:** U.S. Army Armor School (USAARMS), TRADOC; 16th Cavalry Regiment/Armored Warfighting Training Directorate (AWTD), Combined Arms Training Strategies Division and 5th Squadron (Specialty Training and Simulation Squadron)

**TECHNOLOGY TRANSFER:**

**Progress:** As part of the Combined Arms Training Strategy (CATS), the U.S. Army Armor School (USAARMS) is refining descriptive strategies for supporting gunnery and maneuver training events and providing a framework for the increasing use of TADSS. Research support for this effort has included the development of analytic and empirical methods for assessing the training capabilities of TADSS, the determination of the training capabilities of selected TADSS, and the determination of user requirements for a prototype simulation-based performance measurement system (UPAS). Development of an extensive simulation-based training program for armor units has also been initiated.

**Future Products:** Development of a Simulation Networking (SIMNET) training program and associated training methods will provide a prototype training

program and strategy for the Close Combat Tactical Trainer (CCTT) in FY95. Research on application of UPAS will lead to an enhanced simulation-based performance measurement system in FY95. Development of assessment methods and determination of the training capabilities of future TADSS as they become available will continue to provide input for the refinement of the armor portion of CATS. A methodology for defining and validating future training strategies will be transferred to USAARMS in FY98 for use in designing armor training strategies as part of CATS.

#### **FY94 MILESTONES:**

Develop and refine a comprehensive prototype simulation-based (primarily SIMNET) program focused on training Army National Guard (ARNG) armor units

Develop measures and collect baseline data for assessing the effectiveness of alternative simulation-based training methods (e.g., use of enhanced feedback, provision of demonstrations of successful performance) within the context of the ARNG training program

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#### **SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.7 Unit Training Strategies

TECHNOLOGY DEMONSTRATION: N/A

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY92                      END DATE: FY98

FY94 FUNDING (\$000): \$568 PROGRAM ELEMENT/PROJECT: 63007 A793

DIVISION: Training Systems Research Division

TECHNICAL AREA/FIELD UNIT:

Fort Knox Field Unit

ACTIVITY:                      TRADOC (USAARMS)      ARI

POC:	Mr. Mike Kelley (502) 624-2505 DSN 464-2505	Dr. Barbara Black (502) 624-3450 DSN 464-3450
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**TASK TITLE: TRAIN-UP: Technology-Based Reserve Component (RC) Training Strategies (2125)**

**OBJECTIVE:** To devise and demonstrate technology-based training strategies which enhance the effectiveness and efficiency of training RC units with low Operating Tempo (OPTEMPO) at widely dispersed locations.

**APPROACH:** Prototype training strategies with the potential for meeting training requirements within RC constraints (e.g., limited training time, unit/soldier geographical dispersion) will be identified, developed, and evaluated. Appropriate usage (mixing and matching) of different training aids, devices, simulators, and simulations (TADSS), e.g., M-COFT, GUARDFIST I, CCTT, M-SIMNET, and distributed training technologies (e.g., computer conferencing, video teletraining), will be empirically tested using Army National Guard and Army Reserve soldiers/units. Data to be collected will include: soldier, crew, and unit proficiency indicators; commander performance measures; scheduling efficiency information; training attitudes; and estimated training resource requirements. Results will be coordinated with the Combined Arms Training Strategies (CATS) proponents at TRADOC and proponent schools, the National Guard Bureau, OCAR, and FORSCOM.

**IMPACT:** Research results will have direct and immediate applicability to the ARPA Advanced Simulations Project, Armor Training Device Strategy, the Combined Arms Training Strategy, and decisions concerning the acquisition and fielding of different TADSS and distributed training technologies.

**PROPOSERS/SPONSORS:** National Guard Bureau (NGB), DA; Office, Chief of Army Reserve (OCAR), DA; FORSCOM, HQ

**TECHNOLOGY TRANSFER:**

**Progress:** A plan was approved by the NGB to establish a longitudinal database of homestation RC performance and personnel measures. Analyses of NTC National Guard data were made to determine which areas were most deficient and therefore should be the focus for improving homestation training. Findings were reported on the relationship of GUARDFIST and MCOFT training to live fire performance. The effectiveness and efficiency of selected RC-operated LANES training was assessed.

**Future Products:** By the end of FY94, a recommended compressed, TADSS-based, tank gunnery training strategy for the RC will be presented to the CATS proponents at TRADOC, NGB, OCAR, and FORSCOM. The longitudinal database of RC training and personnel measures will be developed. Findings and recommendations for the operation of LANES training by the RC will be presented to FORSCOM, OCAR and the NGB.

Empirical research findings leading to a recommended maneuver training strategy for the RC will be presented in FY98 to proponents.

**FY94 MILESTONES:**

Develop TADSS-based, compressed, tank gunnery training strategy

Initiate development of longitudinal RC database

Report on LANES '93 findings

**SCIENCE AND TECHNOLOGY OBJECTIVE (STO):**

V.B.7 Unit Training Strategies

**TECHNOLOGY DEMONSTRATION:** N/A

**DEFENSE TECHNOLOGY AREA:** Training Systems  
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**START DATE:** FY93                      **END DATE:** FY98

**FY93 FUNDING (\$000):** \$439 **PROGRAM ELEMENT/PROJECT:** 63007 A793

**DIVISION:** Training Systems Research Division

**TECHNICAL AREA/FIELD UNIT:**

Boise Field Element (Fort Knox Field Unit)

<b>ACTIVITY:</b>	DA (NGB)	ARI
<b>POC:</b>	LTC Hargrove DSN 607-7310	Dr. Ruth Phelps (208) 334-9390
	DA (OCAR)	
	COL Johnson DSN 697-3965	
	DA (IDARNG)	
	MG Manning (208) 389-5214	
	FORSCOM (RC)	
	Mr. Fred Stritzinger (404) 752-2991	

**TASK TITLE: COMBAT: Combined Arms Training Strategies (2126)**

**OBJECTIVE:** To develop and demonstrate cost-effective training strategies for combined arms brigade and battalion training.

**APPROACH:** Recent research has provided a wealth of information on combined arms training. This includes information on: high-performing units at the Combat Training Centers; surveys on training in the Army conducted in support of the Combined Arms Training Strategy (CATS); as well as an extensive front-end analysis of combined arms tasks. This information will be supplemented by additional research to develop sets of field tested and proven "good ideas" and strategies for combined arms training. Innovative training methods and training management strategies -- as well as prototype aviation, armor and RC training strategy components resulting from other ARI research - will be synthesized and then field-tested.

**IMPACT:** Empirically-based, field-proven training methods and strategies will provide the Army with information which will help commanders to design and schedule combined arms unit training programs to meet their mission requirements.

**PROPONENT/SPONSOR:** Combined Arms Command-Training (CAC-T), TRADOC

**TECHNOLOGY TRANSFER:**

**Progress:** A report describing the field implementation of TRADOC guidance concerning CATS was completed and submitted to the sponsor. The task analysis approach in terms of content, format, and concept for the Critical Combat Functions (CCF) was approved by the sponsor. Key elements for the training and assessment of CCFs were identified. Structures and blueprints for 24 CCFs were completed.

**Future Products:** Field-tested, experimental combined arms training strategies will be presented to TRADOC (CAC-T) by the end of FY98, with recommendations for their implementation as part of future battalion and brigade CATS.

**FY94 MILESTONES:**

Detailed task analyses will be completed for 24 of the CCFs

Initiate development of training management strategies and materials for the prototype combined arms training program

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SCIENCE AND TECHNOLOGY OBJECTIVES (STO):

V.B.7 Unit Training Strategies

TECHNOLOGY DEMONSTRATION: N/A

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY93                      END DATE: FY98

FY93 FUNDING (\$000): \$492    PROGRAM ELEMENT/PROJECT: 63007 A793

DIVISION: Training Systems Research Division

TECHNICAL AREA/FIELD UNIT:

Presidio of Monterey Field Unit

ACTIVITY:	TRADOC (CAC-T)	ARI
POC:	BG Joe Frazar, III DSN 552-5501	Mr. Michael McCluskey (408) 647-5619 DSN 878-5619

**TASK TITLE: AVIATES: Aviation Training Strategies for Improving Combat Readiness (2224)**

**OBJECTIVE:** To develop and demonstrate an aviation strategy for using training aids, devices, simulations and simulators (TADSS), as a major component of the Combined Arms Training Strategy (CATS) to ensure the combat readiness of aviators and aircrews, while reducing the load on expensive, high fidelity simulators and flying hours.

**APPROACH:** A detailed training requirements analysis will be performed to select candidate tasks as the focus of the research. These tasks will be paired with specific low-cost, part-task training devices to determine the transfer effectiveness of each device in training and sustaining specific aviation knowledges and skills. Using the results of this research, a prototype aviation training system and associated prototype training strategies will be configured. These training strategies will be compared experimentally using the variable fidelity features of the modular-based computer architecture in the Simulator Training Research Advanced Testbed for Aviation (STRATA).

**IMPACT:** Maximizing the use of low-cost training devices will ensure the optimal usage of full scale simulators as a skill and knowledge integrator, leaving virtually all flight hours available for combat mission training.

**PROPONENT/SPONSOR:** U.S. Army Aviation Center (USAAVNC), TRADOC

**TECHNOLOGY TRANSFER:**

**Progress:** Research plan for demonstrating/evaluating effective training systems and strategies using the STRATA simulator. A model for modular, low cost devices based upon Air Force MH-53 total training system. Report on the requirements for low-cost, modular part-task training devices for both initial and advanced tactical skills training strategies and mission planning. Data collection completed on evaluation of a program of instruction which introduced pilots to infrared projected images prior to night vision goggle flight training.

**Future Products:** In FY96, the USAAVNC will be provided with an experimentally validated prototype aviation training strategy, to include: requirements for low-cost, part-task, tactics and combined arms trainers; and assessments of the impact of low-cost devices on combat readiness as measured using field and networked simulators. The USAAVNC will then use the results for developing future TADSS requirements and designing aviation training strategies as part of the Combined Arms Training Strategy (CATS).

**FY94 MILESTONES:**

Completion of requirements determination for low-cost training devices

STRATA will be used to evaluate the effectiveness of different low-cost training devices to be used in an initial training environment

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SCIENCE AND TECHNOLOGY OBJECTIVE (STO):

V.B.7 Unit Training Strategies

TECHNOLOGY DEMONSTRATION: N/A

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY92

END DATE: FY96

FY93 FUNDING (\$000): \$423 PROGRAM ELEMENT/PROJECT: 63007 A793

DIVISION: Training Systems Research Division

TECHNICAL AREA/FIELD UNIT:

Fort Rucker Field Unit

ACTIVITY: TRADOC (USAAVNC) ARI

POC: LTC Ralph Aaron      Mr. Charles Gainer  
DSN 598-3320      (205) 255-4404  
DSN 558-4404



**TASK TITLE: IMPACT: Innovative Methods for Providing Army Classroom Training (2225)**

**OBJECTIVE:** To develop and demonstrate efficient state-of-the-art training technologies that will improve the effectiveness of Army classroom training within a constrained budget.

**APPROACH:** To enhance TRADOC's ability to perform its institutional training mission, the first step will be to match high priority TRADOC classroom training R&D requirements to emerging technologies in the cognitive and computer sciences. Since the Navy Personnel R&D Center (NPRDC) has a large, ongoing research program centered on classroom instruction, interaction with Navy researchers will help gain a clear understanding of work accomplished, problems, and results. Empirical evaluations of the resultant training research concepts, methods, and approaches will be conducted at appropriate Army sites. In addition, computer assisted training technologies developed at NPRDC will be adapted to Army classroom training needs and implemented at appropriate Army sites.

**IMPACT:** Although personnel and training resource cutbacks are foreseen, classroom training will remain a critical and costly component within the TRADOC Long Range Training Strategy. By adopting more efficient classroom training techniques resulting from this effort, TRADOC will be better able to meet its training requirements with reduced resources.

**PROPONENTS/SPONSORS:** Deputy Chief of Staff for Training (DCST), TRADOC

**TECHNOLOGY TRANSFER:**

**Progress:** Knowledge-based representation, knowledge acquisition, ISD, and case-based reasoning technologies researched and developed at NPRDC have been integrated into a prototype knowledge representation system for classroom training. NPRDC's guidance on effective classroom training practices, "What Works", was selected for its utility for Army Training.

**Future Products:** Throughout the project, as more effective classroom training strategies, methods and techniques are demonstrated and validated, they will be transferred to the Army (TRADOC) for immediate consideration and use in its schools and training centers. For example, in FY95, a prototype instruction and control architecture for classroom training will be completed and deployed at appropriate Army sites for evaluation and implementation.

**FY94 MILESTONES:**

Continuous development of the knowledge representation system for classroom training

Implementation of NPRDC's "What Works" in Army classrooms

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SCIENCE AND TECHNOLOGY OBJECTIVE (STO):

V.B.8 Cognitive and Collective Skill Retention

TECHNOLOGY DEMONSTRATION: N/A

DEFENSE TECHNOLOGY AREA: Training Systems

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START DATE: FY93

END DATE: FY95

FY93 FUNDING (\$000): \$110 PROGRAM ELEMENT/PROJECT: 63007 A793

DIVISION: Training Systems Research Division

TECHNICAL AREA/FIELD UNIT: (Research site will be at NPRDC)

ACTIVITY:

TRADOC (TDAD)

ARI

POC:

COL Ross Nagy  
DSN 680-5700

Dr. Robert Seidel  
(703) 274-8838  
DSN 284-8838

Dr. Phil Gillis  
(619) 553-7702  
DSN 553-7702

## **APPENDIX C**

### **Science and Technology Objective (STO) Fact Sheets**

**Science & Technology Objective  
Fact Sheet**

**TITLE:** Soldier Assignment

**Old #:** V.B.1

**New #:** III.Q.1

**Develop improved soldier job match by FY96. Develop improved methods, by FY94, for selecting and assigning quality soldiers to each job to increase combat effectiveness that can potentially help reduce attrition by 15 percent and improve performance by as much as 10 percent. By FY 94, develop methods to empirically determine MOS restructuring options in terms of manpower, personnel and training impacts. Develop by FY95 improved selection procedures for Special Operations/Low Intensity Conflict (SO/LIC) forces, that can potentially reduce attrition by 25 percent.**

**DESCRIPTION:**

**Technology Challenges/Barriers:**

With the rapidly changing world of computer hardware and software, personnel-related operations can be modernized. Automation support does not represent a barrier. Rather, cost-effective application of this technology by the Army and DoD personnel community represents a significant challenge. Research under this STO will provide process guidance for effective computerized selection and assignment for better soldier-job match and procedures for MOS restructuring.

**Realistic Risk Assessment:** Low to Medium

**POTENTIAL USER AGENCIES:**

Director of Military Personnel Management (DMPM), ODCSPER, DA  
U. S. Total Army Personnel Command (PERSCOM), ODCSPER, DA  
U. S. Army Special Operations Command (USASCOC)

**USER REQUIREMENT AND INTEREST:**

The CSA's first imperative is to "recruit and retain quality soldiers" even during a period of draw-down. The Army must recruit military-age men and women to prevent an aging Army. However, the highest quality soldiers must be retained to become the leaders of tomorrow. To increase productivity -- doing more with a smaller force -- the Army must be able to ensure a better soldier-job match (the right person in the right job). Army Military Occupational Specialties (MOS) must be restructured to meet these productivity goals. USASOC, with its quick response contingency mission requires special selection and assignment attention.

## LINKAGES:

DOD, Army & LAM Thrust Area(s):

Thrust # 5 (Advanced Land Combat)

TRADOC Battlefield Dynamics:

Selection and assignment of the right-soldier-to-the-right-job and guidelines for the cost-effective restructuring of MOSs will benefit all Battlefield Dynamics

Army Modernization Objective: Training

Project Reliance:

Research on methods for MOS structuring is being conducted under Project Reliance and TAPSTEM in conjunction with the USAF at Brooks AFB, TX.

## APPLICATION/TRANSITION:

Military Application: Implementation by improved selection, classification, and assignment procedures by DMPM, ODCSPER, and USASOC. Implementation of guidelines for MOS restructuring by DMPM, ODCSPER

Defense Conversion Potential: High dual-use potential. New selection technology and procedures can be adapted for use in industry. (Partnership possibilities may be explored with AT&T). Job (MOS) restructuring technology could also find application in industry as well as in the Services.

PRINCIPAL PERFORMERS: Army Research Institute (Selection and Classification Technical Area)

**Science & Technology Objective  
Fact Sheet**

**TITLE:** Simulation Fidelity

**Old #:** V.B.5

**New #:** IV.J.5

**Determine, by FY95, the least expensive fidelity requirements for training critical individual skills, safety procedures and unit combat tasks. This information will be used for upgrades of the existing inventory of simulators and for specifying acquisition requirements for future aviation simulators. Demonstrate by FY98, technology for training Commanders, Special Forces and infantry teams in virtual environments.**

**DESCRIPTION:**

**Technology Challenges/Barriers:**

Simulation permits low-cost representation of the real world that may be used for a variety of purposes including system design, training and mission rehearsals. However, if all relevant performance parameters are simulated, simulator costs may be so exorbitant that one or only a very few may be procured. This may restrict training to a few locations, particularly training for aviation and armor systems. The ARI Simulator Training Advanced Testbed for Aviation (STRATA), built jointly by the Canadian Government and the U. S. Army, will permit experimental determination of the lowest (physical) fidelity/least expensive simulator/simulation design required for training critical individual skills and safety procedures. Other research will determine the most cost-effective means for training critical individual combatant tasks during small unit operations day and night. In both instances, the technological challenge is not to design a new simulation "system" but to design one that will meet the Army's requirements at the lowest practical cost.

**Realistic Risk Assessment:** Low to medium

**POTENTIAL USER AGENCIES:**

U. S. Army Aviation Center and School, TRADOC

U. S. Army Safety Center, TRADOC

U. S. Army Simulation, Training and Instrumentation Command (STRICOM),  
AMC

## USER REQUIREMENT AND INTEREST:

Training system design and modernization is focusing on simulation as an alternative to almost total reliance on training using actual equipment. Fiscal constraints are also having direct bearing on the design of simulation systems for training; the Army must get cost-effective training for the training ("OPTEMPO") dollar. In addition, the Army must experimentally determine how simulators can be used most cost-effectively for training leading to the reduction of vehicular accidents which are expensive both in lives and dollars.

## LINKAGES:

DOD, Army & LAM Thrust Area(s):

Thrust #6 (Synthetic Environments),  
Supports Louisiana Maneuvers (LAM)

TRADOC Battlefield Dynamics:

As this research program will directly impact the design and utilization of simulators that will be employed under TRADOC's Combined Arms Training Strategy (CATS) this STO supports all Battlefield Dynamics.

Army Modernization Objective:

Fidelity of training simulators and simulations supports all modernization objectives

Project Reliance: N/A

## APPLICATION/TRANSITION:

Military Application: Products will be used by training systems designers and developers to design and develop cost-effective training simulator hardware, software and courseware at the lowest practical cost.

Defense Conversion Potential: High dual-use potential. Supports Defense Conversion Training/Instruction Technology Focus Area (e.g., use of simulation for pilot training to reduce human-induced errors).

PRINCIPAL PERFORMERS: Army Research Institute (Fort Rucker Field Unit, STRICOM (Orlando) Field Unit)

**Science & Technology Objective  
Fact Sheet**

**TITLE:** Foreign Language Skill Training      **Old #:** V.B.6      **New #:** IV.J.6

**Future Army contingency missions to meet regional threats require that selected leaders and soldiers possess the language skills and knowledge essential for working along-side allies and against foeign enemies. By FY95, demonstrate a portable computer-based tutor for foreign language training incorporating recent advances in cognitive learning theories with training delivered by powerful, but affordable, "notebook" size computer systems.**

**DESCRIPTION:**

**Technology Challenges/Barriers:**

The technological challenge is to combine rapid advances in "notebook" computer technology with advances in software capabilities (e.g., natural language parsing software combined with intelligent heuristics) and advances in the cognitive sciences (e.g. tutoring alternatives: diagnosis, prescription and remediation).

**Realistic Risk Assessment:** Low

**POTENTIAL USER AGENCIES:**

Defense Language Institute  
Training Development and Analysis Directorate, DCST, TRADOC

**USER REQUIREMENT AND INTEREST:**

For the foreseeable future, the Army will have to respond to regional conflicts, with relatively little time to prepare. Accurate communication with all parties involved, both enemy and allied forces, may play a crucial role in minor events as well as the eventual outcome of the conflict. Thus language training and refresher training becomes more important than in the past. Technological advances in computer and cognitive science offer a cost-effective means for providing introductory language training (that can be conducted at the learner's own pace) or for providing needed refresher training for intelligence personnel and interrogators. A notebook language tutor can also serve as a job aid.



**LINKAGES:**

DOD, Army & LAM Thrust Area(s): N/A

TRADOC Battlefield Dynamics:

Language training tutors will support language training for quick response contingency missions for all Battlefield Dynamics  
Army Modernization Objective: Win the Information War

Project Reliance: N/A

**APPLICATION/TRANSITION:**

Military Application: Quick response language training in preparation for regional conflicts; on-the-spot refresher training

Defense Conversion Potential: High dual potential. Supports  
Training/Instruction Technology Focus Area with its focus on automated ("intelligent tutor") individual training for foreign languages.

**PRINCIPAL PERFORMERS:** Army Research Institute (Automated Instructional Systems Technical Area)

**Science & Technology Objective  
Fact Sheet**

**TITLE:** Unit Training Strategies

**Old #:** V.B.7

**New #:** III.Q.2

**Combat training readiness for a wide spectrum of conflicts is a top priority for the Army. Training conducted at the various Combat Training Centers (CTC), such as the National Training Center (NTC), represents the standard of excellence which all unit training should aim to achieve. Since units can visit a CTC at the most once a year, most unit training must take place at home station. The Combined Arms Training Strategy (CATS) for units seeks to provide the guidance home station training leaders need to achieve training excellence with constrained budgets and time. The purpose of this research is to design the most cost-effective home station training management strategies for the entire range of possible missions and especially those involving rapid deployment for contingency operations in regional conflicts. By FY93, demonstrate a performance assessment and training feedback system for Close Combat Tactical Trainer (CCTT). By FY94, provide training strategies for Reserve Component (RC) units, including an armor gunnery training strategy optimized for RC use, to compensate for limited training time. By FY95, demonstrate a computer-based program for training commanders to accurately "visualize" dynamically changing battlefield conditions. By FY96, validate training strategies for combined arms training using the CCTT, including ADA and signal operations. By FY97, complete a preliminary CATS prototype. By FY98, demonstrate a validated CATS which provides practical guidance for selecting the proper mix of individual and collective training resources -- to include operational equipment and "live fire" -- to meet specific mission training objectives.**

**DESCRIPTION:**

**Technology Challenges/Barriers:** The AMP states that "The training vision for the year 2000 and beyond is to produce a seamless simulation environment which allows actual combat systems, manned simulators and other simulations to exercise on a virtual battlefield." However, HASC Report 101-665 recognized that "The effective application of technological advances in the design of realistic and effective combined arms training systems gives every indication of being even more difficult to achieve than were the technology advances." If TRADOC is to successfully develop and implement CATS, it must have a research basis for its strategy design decisions.

**Realistic Risk Assessment:** Medium

## POTENTIAL USER AGENCIES:

U. S. Army Simulation, Training and Instrumentation Command (STRICOM),  
AMC  
TRADOC System Manager for Combined Arms Tactical Trainer (TSM-CATT),  
TRADOC  
Combined Arms Center - Training (CAC-T), TRADOC  
Training Analysis and Development Division, TRADOC  
U. S. Armor School, TRADOC  
Office, Chief of Army Reserves (OCAR)

## USER REQUIREMENT AND INTEREST:

Distributed Interactive Simulation (DIS) and virtual reality technologies are two technologies, which if properly integrated, will permit the development of synthetic battlefields for training that complement field training exercises such as the National Training Center or the Air Force's "Red Flag." The Army needs supporting manpower, personnel and training R&D to empirically determine the most cost-effective training strategies for utilization of all training resources and to refine methods for the measurement of collective performance for the conduct of more effective After Action Reviews (AAR) and for the assessment of individual and unit readiness.

## LINKAGES:

DOD, Army & LAM Thrust Area(s):

ARPA ATD #1 (Southwest USA "Theater of War")  
Thrust #6 (Synthetic Environments)  
Supports Louisiana Maneuvers (LAM)

TRADOC Battlefield Dynamics:

The research efforts under this STO directly support the development and validation of TRADOC's Combined Arms Training Strategy (CATS) and, hence, all Battlefield Dynamics

Army Modernization Objective:

CATS training strategies support all modernization objectives

Project Reliance: N/A

#### **APPLICATION/TRANSITION:**

**Military Application:** Direct support of design, development, validation, and implementation of TRADOC's Combined Arms Training Strategy (CATS)

**Defense Conversion Potential:** Medium dual-use potential. Strategies for training small groups in real-world and simulated training environments could find application in civilian applications requiring training for individual participants to work together in a coordinated fashion. Examples include training for police SWAT teams, medical emergency response teams (both in hospital and ambulance settings, assembly operations involving interacting individuals). Thus, this effort could support the Health Care Technology, Training/Instruction and Information Infrastructure Technology Development focus areas.

**PRINCIPAL PERFORMERS:** Army Research Institute (elements of the Training Systems Research Division)

**Science & Technology Objective  
Fact Sheet**

**TITLE:** Individual Cognitive and Collective Skill Retention Old #:V.B.8 New#:IV.J.8

**To ensure a combat-ready force, individual cognitive skills and collective skills must be maintained. For individual skill training: a) by FY94, skill decay models for critical cognitive skills will be validated; b) by FY95, classroom instructional strategies for improving cognitive skill acquisition, largely based on technologies transferred from Navy research under Project RELIANCE, will be demonstrated at appropriate schools. For collective training: by FY95, a validated crew/team task performance model for predicting collective skill acquisition and decay will be demonstrated.**

**DESCRIPTION:**

**Technology Challenges/Barriers:**

**A computerized process model must be developed to predict decay parameters (response times and error types) for crew/team collective performance. Research on the most cost-effective classroom training technologies will be conducted with the Navy in San Diego under Project Reliance/TAPSTEM agreement.**

**Realistic Risk Assessment: Low**

**POTENTIAL USER AGENCY:**

**Training Development and Analysis Directorate (TDAD), DCST, TRADOC**

**USER REQUIREMENT AND INTEREST:**

**Individual and collective combat skill decay degrades combat capability, reducing the warrior's edge. Army trainers need models they can use for determining the most cost effective scheduling of training. They also need guidance on what advanced classroom training technologies should be used to meet specific refresher training requirements.**

**LINKAGES:**

**DOD, Army & LAM Thrust Area(s): N/A**

**TRADOC Battlefield Dynamics:**

**Products from this research program will benefit individual and crew/team training for all Battlefield Dynamic areas.**

**Army Modernization Objective:**

Training programs support all modernization objectives

**Project Reliance:**

State-of-the-art training technologies will be developed with the Navy personnel R&D Center (NPRDC) in San Diego, CA under Project Reliance.

**APPLICATION/TRANSITION:**

**Military Application:** DoD classroom training. Home station crew/team training scheduling

**Defense Conversion Potential:** High potential for spin-off of already-developed research products and high potential for dual-use of products from future joint Navy/Army R&D.

**PRINCIPAL PERFORMERS:**

Navy Personnel R&D Center (NPRDC) and Army Research Institute (Presidio of Monterey Field Unit & Automated Instructional Systems Technical Area)

## Science & Technology Objective Fact Sheet

TITLE: Leader and Command Staff Training    Old #: V.B.9        New #: IV.J.9

A power-projection Army demands that combat leaders and staffs be able to operate effectively and efficiently in a rapid-paced environment across the spectrum of conflict. By FY95, demonstrate prototype method to improve command group readiness training that requires fewer support personnel. By FY96, demonstrate simulation technology for development and assessment of leader conceptual and cognitive skills. By FY98, demonstrate simulation-based training strategies to optimize brigade through corps command performance.

### DESCRIPTION:

#### Technology Challenges/Barriers:

This research will explore new technologies that can be used to assess the relative contribution of various characteristics that define the effective leader. Possible approaches include biographical data, cognitive assessments and assessment of tacit leadership knowledge. Models will then be developed to provide guidance for successive, critical stages in an officer's career. In addition, this effort will empirically identify required improvements for the Army's Battle Command Training Program (BCTP), which is the Army's primary simulated training environment for training commanders in effective command and control procedures.

Realistic Risk Assessment: Low

### POTENTIAL USER AGENCIES:

Combined Arms Command - Training, TRADOC  
Center for Army Leadership, USAC&GSC, TRADOC  
Army War College

### USER REQUIREMENT AND INTEREST:

Effective leader performance is the sine qua non for effective unit performance. The Army makes a significant investment in the training and career development of warfighting leaders. TRADOC requires an empirical basis for developing officer career development models and procedures. In addition, CAC-T needs an empirical basis for making changes to improve the training- and cost-effectiveness of the BCTP.

## **LINKAGES:**

**DOD, Army & LAM Thrust Area(s):**

**ARPA ATD#1 (Southwest USA "Theater of War")  
Thrust #6 (Simulated Environments)  
Supports Louisiana Maneuvers (LAM)**

**TRADOC Battlefield Dynamics:**

**Leader training and officer career development have a significant impact on all Battlefield Dynamics**

**Army Modernization Objective:**

**Leader training and development supports all modernization objectives**

**Project Reliance: N/A**

## **APPLICATION/TRANSITION:**

**Military Application: Research products will be used by the Army in general to guide officer career development. Other products will be used by CAC-T in improve BCTP.**

**Defense Conversion Potential: High dual-use potential. Technologies, techniques and procedures developed for the Army could find application in industry for both individual career development, as well as in the design of simulated collective (group) training exercises.**

**PRINCIPAL PERFORMERS: Army Research Institute (Fort Leavenworth Field Unit, Strategic Leadership Technical Area, Leadership and Organizational Change Technical Area)**



**Appendix D**

**Manpower, Personnel and  
Training Program  
Time Lines**

## HUMAN RESOURCE DEVELOPMENT

### Leader/Organizational Development

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
1111: LEADER TECH: Leader Skill Assessment and Development Technologies						1115: LEADER TECH II	
1121: GROUP WORK: Technologies for Enhancing Command-Staff Organizational Performance					1123: GROUP WORK II: Advanced Technologies for Enhancing Command Staff Organizational Performance		
1122: COMMAND STAFF: Command Staff Performance Enhancement			1124: COMMAND STAFF II: Advanced Technologies for Command Staff Performance Enhancement				

### Career Development and Retention

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
1311: LIFELINE: The Life Course Approach to Human Resource Development Processes							
1312: ARMY FAMILIES: Family Factors In Maintaining Readiness During Downsizing							
					1322: Techniques to Enhance Personnel Decision Making		
1223: Special Forces: Improving Special Forces Personnel Development			1224: Special Forces Personnel Development				

### Survey Technology

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
1321: PROFILES: Personnel Survey and Database Technologies					1323: PROFILES II: Advanced Personnel Survey and Database Technologies		

### LEGEND:

Exploratory Development (6.2) Task	Advanced Development (6.3A) Task
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## SELECTION AND CLASSIFICATION

### General Selection and Classification Techniques

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
1212: CAREER FORCE: <i>Building the Career Force</i>		1217: CAREER FORCE II: <i>NCO Utilization</i>					
1213: NEW MOS: <i>Military Occupational Specialty (MOS) Restructuring</i>		121Y: <i>TBD</i>					

### Specialized Selection and Classification Techniques

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
1211: QUALITY SOLDIERS: <i>Alternative Selection and Evaluation Techniques</i>		1214: OFFICER PREDICTION: <i>New Measures for Predicting Officer Success</i>					
1221: JOB MATCH: <i>Determining Minimal Entry Qualifications</i>		1218: <i>Job Classification</i>					
1215: <i>Performance-Based Classification</i>							
1216: <i>Improved Aptitude Testing</i>							
1222: TOMORROW'S WARRIOR: <i>Army Selection and Classification: General Models and MOS Specific Needs</i>		1225: TOMORROW'S WARRIOR II					

### LEGEND:

Exploratory Development (6.2) Task	Advanced Development (6.3A) Task
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## UNIT COLLECTIVE TRAINING TECHNOLOGIES

### Synthetic Training Environments

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
2111: VIRTUE: Virtual Environments for Combat Training and Mission Rehearsal							2117: VIRTUE II
2112: RECOLLECT: Acquisition and Retention of Collective Skills in Synthetic Training Environments			2115: DIAMONDS: Diagnostic Models in Synthetic Training Environments				
2113: DESYNE: Technology for Designing Collective Training in Synthetic Environments					2116: INTACT: Intelligent Agents for Collective Training		
2114: SYNTRAIN: Development of Advanced Training Technologies for Distributed Interactive Simulation (DIS) Systems						2118: SYNTRAIN II	

### Unit Training Strategies

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
2121: BATTLEVIEW: Visualization of the Battlefield							212E: BATTLEVIEW II
2122: MOSES: Military Operational Simulation and Evaluation Systems				2129: JOSHUA: Joint Ops Simul of Hostile Aggress			212D: JERICO: Joint Engagement Rights for Instr in Comb Arms
2123: BATTLESTAFF: Battle Staff Training and Integration		2127: LIC-T: Low Intensity Conflict (LIC) Training					212C: LIC-T II
2124: STRONGARM: Strategies for Training and Assessing Armor Commanders' Performance with Devices and Simulations							212A: STRENGTHS: Strategies for Training Enhancement with Networked Gunnery and Tactical Simulators
2125: TRAIN-UP: Technology-Based Reserve Component (RC) Training Strategies							212B: TRAIN-UP II
2126: COMBAT: Combined Arms Training Strategies							
2224: AVIATES: Aviation Training Strategies for Improving Combat Readiness				2227: AVIATES II			
							2128: IPCAT: Adv Technologies for Comb Arms Unit Tng & Perf

### LEGEND:

Exploratory Development (6.2) Task	Advanced Development (6.3A) Task
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## LAND WARFARE AND ROTARY WING TRAINING

### Task Training Fidelity Requirements

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
2211: STRATA-FI: Simulation Fidelity Requirements for Cost-Effective Aviation Training							2212: STRATA-FI II

### Combat Skills Training Methods and Strategies

PRIOR YEARS		FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
2221: TANTAMOUNT: Technologies for Advanced Mounted Warfare Training					2226:DISMOUNT: Distributed Training Technologies for Mission Rehearsal in Multi-National Airland Operations			
2223: NIGHTFIGHTER: Training Technologies for Night Operations						222B: NIGHTFIGHTER II		
2225: <i>IMPACT: Innovative Methods for Providing Classroom Training</i>				222A: <i>IMPACT II</i>				

### Foreign Language Tutoring Technologies

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
2231: MULTI-LINGUAL: Advanced Technologies for Mastering Foreign Languages							
				2232: VITAL: Virtual Immersion Technology to Advance Language Learning			

### Safety Training Technologies and Strategies

PRIOR YEARS	FY94	FY95	FY96	FY97	FY98	FY99	FY00 +
2242: SAFETRAIN II: Aviation Safety Training Technologies							2243: SAFETRAIN III

### LEGEND:

Exploratory Development (6.2) Task	Advanced Development (6.3A) Task
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